BRITISH COLUMBIA
MINISTRY OF FORESTS AND RANGE

Revelstoke Timber Supply Area

Rationale for Allowable Annual Cut (AAC) Determination

Effective September 1, 2005

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Chief Forester

Table of Contents

Objective of this document 3
Description of the Revelstoke timber supply area 3
History of the AAC 4
New AAC determination 4
Information sources used in this AAC determination 5
Role and limitations of the technical information used 6
Statutory framework for AACs 7
Guiding principles for AAC determinations 7
The role of the base case 10
Base case for the Revelstoke TSA 11
Consideration of Factors as Required by Section 8 of the *Forest Act* 13
Land base contributing to timber harvest 13
- general comments 13
- physical and economic operability 14
- Mount Mackenzie ski resort development 15
- environmentally sensitive areas 16
- unmerchantable forest types 18
- protected areas 20
Existing forest inventory 21
- current inventory 21
- volume estimates for existing stands 22
Expected rate of growth 23
- site productivity estimates 23
- volume estimates for regenerated stands 25
i) operational adjustment factors 25
ii) the use of select seed 26
Regeneration delay and impediments to prompt regeneration 27
Not-satisfactorily-restocked areas 27
Silvicultural systems 29
Rehabilitation programs 29
Incremental silviculture 29
Utilization standards 30
Decay, waste and breakage 30
Integrated resource management objectives 31
- visually sensitive areas 32
- identified wildlife 34
- ungulate winter range 35
- caribou habitat 37
- riparian habitat 40
- community and domestic watersheds 41
- biodiversity 42
1. stand-level biodiversity 42
2. landscape-level biodiversity 43
First Nations 49
- Overview 49

- Kutunaxa/Kinbasket Tribal Council (KKTC) 50
- Okanagan Nation Alliance (ONA) 50
- Shuswap Nation Tribal Council (SNTC) 51
- Shuswap Indian Band* 53
- Consultation Process 53

Forest development plans and harvest sequencing 54
Alternative harvest flows 55
Community implications 56
Minister's letter and memorandum 57
Local objectives 57
Unsalvaged losses 58
Reasons for Decision 59
Determination 63
Implementation 63
Appendix 1: Section 8 of the *Forest Act* 65
Appendix 2: Section 4 of the *Ministry of Forests Act* 68
Documents attached: 68
Appendix 3: Minister of Forests' letter of July 28, 1994 68
Appendix 4: Minister of Forests' memo of February 26, 1996 68
Appendix 5: Summary of Public Input 68

Objective of this document

This document is intended to provide an account of the factors I have considered and the rationale I have employed as chief forester of British Columbia in making my determination, under Section 8 of the *Forest Act*, of the allowable annual cut (AAC) for the Revelstoke timber supply area (TSA). This document also identifies where new or better information is needed for incorporation into future determinations.

Description of the Revelstoke timber supply area

The Revelstoke timber supply area is situated in the eastern portion of the Southern Interior Forest Region and is administered by the B.C. Forest Service (BCFS) Columbia Forest District office, located in Revelstoke.

The Columbia Forest District comprises a large area including two TSAs (Golden and Revelstoke), Tree Farm Licences (TFLs) 55 and 56, a portion of Tree Farm Licence 23, Mount Revelstoke National Park, and Glacier National Park. The Trans Canada Highway and a major railway pass through the southern portion of the TSA and provide relatively easy access to an area of outstanding mountain scenery.

The Revelstoke TSA is situated within the traditional lands of the Ktunaxa/Kinbasket Nation, Okanagan and the Shuswap Nations. There are no First Nation reserve communities within the TSA.

The TSA covers 549 420 hectares of rugged and mountainous terrain. About 222 822 hectares, or 41 percent of the total TSA area is considered forested land managed by the BCFS. The area defined as the timber harvesting land base, 78 018 hectares, represents about 35 percent of the productive forest land base following area exclusions for factors such as poor operability, environmental sensitivity and unmerchantable forest types.

The productive forest in the TSA falls nearly equally into the Interior Cedar-Hemlock (ICH) and the Englemann Spruce-Subalpine Fir (ESSF) biogeoclimatic zones. The main commercial tree species are western hemlock, Englemann spruce, western redcedar, subalpine fir (balsam), and Douglas-fir.

The forests of the Revelstoke TSA provide a variety of habitat for wildlife, including large animals such as black bear, grizzly bear, moose, elk, mule deer, mountain goat, and mountain caribou. The TSA provides important habitat for the Revelstoke caribou herd.

The economy is relatively well diversified; the forestry, tourism, public service and construction sectors provide over 85 percent of the total employment. The mountainous terrain provides excellent winter recreational opportunities for heli and downhill skiing, back-country skiing, and snowmobiling. Revelstoke is the largest community in the TSA, and approximately 93 percent of the 8062 residents (2001 census) in the TSA reside there.

Timber processing facilities located in the TSA include mills operated by all three forest licence holders – Downie Street Sawmills Ltd., Bell Pole Company, and Joe Kozek Sawmills Ltd., – as well as three smaller mills, all located in the city of Revelstoke. Between 65 and 85 percent of the timber harvested in the TSA is milled locally, with the remaining timber typically comprised of pulpwood which is shipped elsewhere. Additional timber from outside the TSA is also secured to meet the timber requirements of local mills. The total volume of timber processed annually by mills in the TSA averaged about 330 000 cubic metres between 2000 and 2002.

History of the AAC

In 1981, the total land base for the TSA was 248 619 hectares. At that time an analysis was completed which resulted in the determination of an allowable annual cut (AAC) of 130 000 cubic metres. Various factors, including the addition of area to the TSA from Tree Farm Licence (TFL) 23 in 1985 resulted in an increase in AAC of 139 000 cubic metres. From 1985 to 1994, the AAC for the TSA was set at 269 000 cubic metres.

In 1995, following a timber supply review, the AAC was determined at 230 000 cubic metres. The harvest level was redetermined in 1999 at the same level, and is currently apportioned by the Minister of Forests as follows:

Apportionment	Cubic metres/year	Percent of AAC
Replaceable forest licences (3)	169 815	73.8
Timber sales licences < 10,000 m3/yr (3)	12 597	5.5
BCTS Timber Sale Licence	42 933	18.7
Woodlots	55	0.0
Forest Service Reserve	4 600	2.0
Total AAC	230 000	100.0

New AAC determination

Effective September 1, 2005, the new AAC for the Revelstoke TSA will be 230 000 cubic metres. This AAC will remain in effect until a new AAC is determined, which must take place within five years of the present determination unless a postponement is authorized. (Please note the possibility of an earlier redetermination, discussed below in 'Reasons for Decision.').

Information sources used in this AAC determination

The information sources used in this determination include but are not limited to:

- *Revelstoke Timber Supply Area (TSA) Data Package and Information Report*, British Columbia Forest Service (BCFS), June 2003;
- *Revelstoke TSA Analysis Report*, BCFS, September 2004;
- *Revelstoke TSA Public Discussion Paper*, BCFS, September 2004;
- *Revelstoke Timber Supply Area (TSA) Data Package and Information Report*, BCFS, November 1997;
- *Revelstoke TSA Analysis Report*, BCFS, December 1998;
- *Revelstoke TSA Public Discussion Paper*, BCFS, December 1998;
- *Revelstoke TSA Rationale for AAC determination*, BCFS, August 1999;
- *Revelstoke TSA Summary of Public Input on Data Package and TSA Analysis Report*, BCFS, August 1999;
- *Revelstoke TSA Inventory Audit*, BCFS Resources Inventory Branch, June 2004 (draft, recompiled);
- *Revelstoke Timber Supply Analysis*, BCFS, June 1993;
- *Revelstoke TSA Rationale for AAC determination*, BCFS, August 26, 1994;
- *Working Paper 36/1998, Site Index Adjustments for Old-Growth Stands based on Veteran Trees*, Nigh, G.D., BCFS Research Branch, 1998;
- *Working Paper 37/1998, Site Index Adjustments for Old-Growth Stands Based on Paired Plots*, Nussbaum, A.F., BCFS Research Branch, 1998;
- Letter from the Minister of Forests to the chief forester, dated July 28, 1994, stating the economic and social objectives of the Crown;
- Memorandum from the Minister of Forests to the chief forester, dated February 26, 1996, stating the Crown's economic and social objectives for the province regarding visual resources;
- First Nations Profiles, Indian and Northern Affairs Canada and British Columbia First Nations websites;
- *Registered Population as of August, 2002*, Indian and Northern Affairs Canada;
- Order Establishing Provincial Non-Spatial Old Growth Objectives – Effective June 30, 2004;
- Section 7 Notice – Indicators of the Amount, Distribution and Attributes of Wildlife Habitat Required for the Winter Survival of Ungulate Species in the Revelstoke Timber Supply Area, December 2004;

- Section 7 Notice – Indicators of the Amount, Distribution and Attributes of Wildlife Habitat Required for Survival of Species at Risk in the Columbia Forest District, December 2004;
- *Revelstoke and Area Land Use Plan – Final Recommendations,* October, 1999;
- *Revelstoke Higher Level Plan Order,* Government of B.C., 2005;
- *A Strategy for the Recovery of Mountain Caribou in British Columbia,* The Mountain Caribou Technical Advisory Committee, Ministry of Water Land and Air Protection, September 2002;
- *BC's Mountain Caribou: Last Chance for Conservation,* Special Report, B.C. Forest Practices Board, 2004;
- *Identified Wildlife Management Strategy, Version 2004,* Government of B.C., 2004;
- *Forest Practices Code of British Columbia Act*, July 1995;
- *Forest Practices Code of British Columbia Act Regulations and Amendments*, April 1995;
- *Forest Practices Code of British Columbia Guidebooks*, BCFS and MELP;
- *Forest Practices Code Timber Supply Analysis*, BCFS and MELP, February 1996;
- Letter from the Deputy Ministers of Forests and Environment, Lands and Parks, dated August 25, 1997, conveying government's objectives regarding the achievement of acceptable impacts on timber supply from biodiversity management; and,
- Technical review and evaluation of current operating conditions through comprehensive discussions with staff of the BCFS, and the Ministries of Water Land and Air Protection and Sustainable Resources Management, including the AAC determination meeting held in Revelstoke, March 1 and 2, 2005.

Role and limitations of the technical information used

Section 8 of the *Forest Act* requires the chief forester to consider biophysical as well as social and economic information in AAC determinations. A timber supply analysis, and the inventory and growth and yield data used as inputs to the analysis, typically form the major body of technical information used in AAC determinations. Timber supply analyses and associated inventory information are concerned primarily with biophysical factors—such as the rate of timber growth and definition of the land base considered available for timber harvesting—and with management practices.

However, the analytical techniques used to assess timber supply are necessarily simplifications of the real world. There is uncertainty about many of the factors used as inputs to timber supply analysis due in part to variations in physical, biological and social conditions, although ongoing science-based improvements in the understanding of ecological dynamics will help reduce some of this uncertainty.

Furthermore, technical analytical methods such as computer models cannot incorporate all of the social, cultural and economic factors that are relevant when making forest management decisions. Therefore, technical information and analysis do not necessarily provide complete answers or solutions to forest management problems such as AAC determinations. The information does, however, provide valuable insight into potential impacts of different resource-use assumptions and actions, and thus forms an important component of the information required to be considered in AAC determinations.

In making the AAC determination for the Revelstoke TSA, I have considered known limitations of the technical information provided, and I am satisfied that the information provides a suitable basis for my determination.

Statutory framework for AACs

Section 8 of the *Forest Act* requires the chief forester to consider particular factors in determining AACs for timber supply areas and tree farm licences. Section 8 of the Act, consolidated to December 31, 2004, is reproduced in full as Appendix 1.

Guiding principles for AAC determinations

Current forest management practices in British Columbia follow the standards and legislation set out by the *Forest Practices Code*. When the *Forest and Range Practices Act* (FRPA) becomes fully implemented, which is expected to occur by December 2006, this Act will guide forest management practices in the province. Under FRPA, forest companies must outline in forest stewardship plans how they can best achieve objectives set by government for wildlife, fish and biodiversity as well as for soils, timber, water and cultural heritage values. Government may also require results or strategies for the special management of areas of local concern, such as wildlife habitat areas, winter range for animals such as deer and mountain goats, community watersheds, fisheries-sensitive watersheds, recreation trails and scenic vistas.

Because the new regulations of the *Forest and Range Practices Act* are designed to maintain the integrity of British Columbia's forest stewardship through responsible forest practices, it is not expected that the implementation of the legislative changes will significantly affect current timber supply projections made using the Code as a basis for defining current practice.

In determining AACs in context of these provincial requirements for forest management practices and in the context of change in its many forms, I proceed under a set of stated principles as follows.

Rapid changes in social values and in the understanding and management of complex forest ecosystems mean there is always uncertainty in the information used in AAC determinations. In making the large number of periodic determinations required for British Columbia's many forest management units, administrative fairness requires a reasonable degree of consistency of approach in incorporating these changes and

uncertainties. To make my approach in these matters explicit, I have set out the following body of guiding principles. In any specific circumstance where I may consider it necessary to deviate from these principles, I will explain my reasoning in detail.

Two important ways of dealing with uncertainty are:

(i) minimizing risk, in respect of which in making AAC determinations I consider particular uncertainties associated with the information before me and attempt to assess and address the various potential current and future, social, economic and environmental risks associated with a range of possible AACs; and

(ii) redetermining AACs frequently, in cases where projections of short-term timber supply are not stable, to ensure they incorporate current information and knowledge—a principle that has been recognized in the legislated requirement to redetermine these AACs every five years. This principle is central to many of the guiding principles that follow.

In considering the various factors that Section 8 of the *Forest Act* requires the chief forester to take into account in determining AACs, I attempt to reflect, as closely as possible, operability and forest management factors that are a reasonable extrapolation from current practices. It is not appropriate to base my decision on unsupported speculation with respect to factors that could work to *increase* the timber supply—such as optimistic assumptions about harvesting in unconventional areas, or using unconventional technology, that are not substantiated by demonstrated performance—or with respect to factors that could work to *reduce* the timber supply, such as integrated resource management objectives beyond those articulated in current planning guidelines or the Forest Practices Code—'the Code'—which is now in transition to the Province's *Forest and Range Practices Act*, FRPA.

In many areas the timber supply implications of some legislative provisions, such as those for landscape-level biodiversity, remain uncertain, particularly when considered in combination with other factors. In each AAC determination I take this uncertainty into account to the extent possible in context of the best available information.

As British Columbia progresses toward the completion of strategic land use plans, in some cases the eventual timber supply impacts associated with land-use decisions resulting from various regional and sub-regional planning processes remain subject to some uncertainty before formal approval by government. In determining AACs, consistent with the approach employed by previous chief foresters, it has been and remains my practice not to speculate on timber supply impacts that may eventually result from land-use decisions not yet finalized by government.

In some cases, even when government has made a formal land-use decision, it is not necessarily possible to fully analyze and account for the consequent timber supply impacts in a current AAC determination. Many government land-use decisions must be followed by detailed implementation decisions requiring for instance the establishment of

resource management zones and resource management objectives and strategies for those zones. Until such implementation decisions are made it would be impossible to fully assess the overall impacts of the land-use decision. In such cases the legislated requirement for frequent AAC reviews will ensure that future determinations address ongoing plan implementation decisions. Wherever specific protected areas have been designated by legislation or by order in council, these areas are deducted from the timber harvesting land base (THLB) and are not considered to contribute any harvestable volume to the timber supply in AAC determinations, although they may contribute indirectly by providing forest cover to help in meeting other objectives, for example for biodiversity or for community watersheds.

For the Revelstoke TSA, recommendations from the Revelstoke and Area Land-Use Planning Minister's Advisory Committee (MAC) guide practices. In 1995, this committee was created to make recommendations to government on how the Kootenay-Boundary Land-Use Plan should be implemented locally in the Revelstoke area. Recommendations were developed between 1996 and 1998 and have guided operational practices in the Revelstoke TSA since that time. The Revelstoke and Area Land Use Planning Final Recommendations (October 1999) developed by the Revelstoke Minister's Advisory Committee were endorsed by government in April 2001. From the MAC recommendations, the Revelstoke Higher Level Plan order was filed in March of 2005.

Where appropriate, I will consider information on the types and extent of planned and implemented intensive silviculture practices as well as relevant scientific, empirical and analytical evidence on the likely magnitude and timing of their timber supply effects.

Some interested persons have suggested that, given the large uncertainties present with respect to much of the data in AAC determinations, any adjustments in AAC should wait until better data are available. I agree that some data are not complete, but this will always be true where information is constantly evolving and management issues are changing. Moreover, in the past, waiting for improved data created the extensive delays that resulted in the urgency to redetermine many outdated AACs between 1992 and 1996. In any case, the data and models available today are superior to those available in the past, and will undoubtedly provide for more reliable determinations.

Others have suggested that, in view of data uncertainties, some AACs should be immediately reduced in the interest of caution. However, any AAC determination I make must be the result of applying my judgement to the available information, taking any uncertainties into account. Given the large impacts that AAC determinations can have on communities, no responsible AAC determination can be made solely on the basis of a response to uncertainty. Nevertheless, in making my determination, I may need to make allowances for risks that arise because of uncertainty.

With respect to First Nations' issues, I am aware of the Crown's legal obligations resulting from decisions in recent years in the Supreme Court of Canada. The AAC that I determine should not be construed as limiting the Crown's obligations under these

decisions in any way, and in this respect it should be noted that my determination does not prescribe a particular plan of harvesting activity within the Revelstoke TSA. It is also independent of any decision by the Minister of Forests and Range with respect to subsequent allocation of the wood supply. I consider those aboriginal interests raised during the consultation process associated with timber supply review. As I am able, within the scope of my authority under section 8 of the *Forest Act*, I address those interests. When aboriginal interests are raised that are outside of my jurisdiction, I will endeavour to forward these interests for consideration to other decision-makers.

Overall, in making AAC determinations, I am mindful of the mandate of the Ministry of Forests and Range as set out in Section 4 of the *Ministry of Forests Act*, and of my responsibilities under Section 8 of the *Forest Act*, under the Code, and under the new *Forest and Range Practices Act*.

Because the new regulations of the *Forest and Range Practices Act* are designed to maintain the integrity of British Columbia's forest stewardship through responsible forest practices, it is not expected that the implementation of the legislative changes will significantly affect current timber supply projections made using the Code as a basis for definition of current practice.

The role of the base case

In considering the factors required under Section 8 of the *Forest Act* to be addressed in AAC determinations, I am assisted by timber supply forecasts provided to me through the work of the Timber Supply Review program for TSAs and TFLs.

For each AAC determination for a TSA, a timber supply analysis is carried out using data and information from three categories—land base inventory, timber growth and yield, and management practices. Using this set of data and a computer model (in the case of the Revelstoke TSA, FSSIM), a series of timber supply forecasts is produced, reflecting different decline rates, initial harvest levels, and potential trade-offs between short- and long-term harvest levels.

From this range of forecasts produced, one is chosen which attempts to avoid excessive changes from decade to decade and significant timber shortages in the future, while ensuring the long-term productivity of forest lands. This is known as the "base case" forecast, and forms the basis for comparison when assessing the effects of uncertainty on timber supply.

Because it represents only one in a number of theoretical forecasts, and because it incorporates information about which there may be some uncertainty, the base case forecast for a TSA is not an AAC recommendation. Rather, it is one possible forecast of timber supply, whose validity—as with all the other forecasts provided—depends on the validity of the data and assumptions incorporated into the computer simulation used to generate it.

Therefore, much of what follows in the considerations outlined below is an examination of the degree to which all the assumptions made in generating the base case forecast are realistic and current, and the degree to which its predictions of timber supply must be adjusted, if necessary, to more properly reflect the current situation.

These adjustments are made on the basis of informed judgement, using currently available information about forest management, which may well have changed since the original information package was assembled. Forest management data is particularly subject to change during periods of legislative or regulatory change, or during the implementation of new policies, procedures, guidelines or plans.

Thus it is important to remember, in reviewing the considerations which lead to the AAC determination, that while the timber supply analysis with which I am provided is integral to those considerations, the AAC determination itself is not a calculation but a synthesis of judgement and analysis in which numerous risks and uncertainties are weighed. Depending upon the outcome of these considerations, the AAC determined may or may not coincide with the base case forecast. Judgements that may be based in part on uncertain information are essentially qualitative in nature and, as such, are subject to an element of risk. Consequently, once an AAC has been determined, no additional precision or validation may be gained by attempting a computer analysis of the combined considerations to confirm the exact AAC determined.

Base case for the Revelstoke TSA

The base case harvest forecast presented in the September 2004 *Revelstoke Timber Supply Area Analysis Report* incorporated the most current available information on forest management, land base and timber yields for the TSA. Specific assumptions about the TSA and the management of its forests are discussed in detail in the analysis report. Some of the assumptions in the 2004 analysis which differ from those in the 1998 analysis are as follows:

- the recommendations of the Minister's Advisory Committee (MAC), as endorsed in 2001 by government, are reflected in the base case. The MAC recommendations, including direction for the management of caribou and other ungulate habitat, visually sensitive areas, and landscape-level biodiversity, have guided operational practices in the Revelstoke TSA since 1998;
- estimates to account for operability, for environmentally sensitive areas, for problem forest types, and for productive forest lost due to the construction of roads, trails and landings have been refined. These modifications resulted in an increase in the size of the timber harvesting land base by 14 500 hectares compared to the previous analysis;
- updated mapping for caribou and other ungulate habitat resulted in an increase in the size of both the productive forest and the timber harvesting land base managed for all species;
- the modelling for landscape level biodiversity includes the use of mapped biodiversity emphasis options, and assumptions for levels of natural disturbance in the non-timber harvesting land base; and

- an accounting was made for the retention of wildlife trees to meet stand-level biodiversity objectives.

Estimates for timber volumes lost and unsalvaged on the timber harvesting land base, totalling 9219 cubic metres annually, were also applied across the entire analysis time horizon.

Given the specific assumptions applied in the base case, the results indicated that a harvest level of 230 000 cubic metres (equivalent to the current AAC for the Revelstoke TSA) per year could be achieved for the first 20 years, before declining by 10 percent per decade for three decades, followed by an additional decline of two percent, to a mid-term level of 165 000 cubic metres per year. This mid-term level could be maintained for nine decades before increasing by three percent to the long-term level of 170 500 cubic metres per year.

In addition to the base case, I was provided with a number of sensitivity analyses and alternative harvest forecasts, projected using the base case as a reference. All of these analyses have been of assistance to me in considering the factors leading to my determination.

I note that I will discuss in this rationale many of the analysis assumptions in the context of my considerations for this AAC determination. However, for some factors, my review of the assumptions has indicated that I am satisfied the factor was appropriately modelled in the base case of the timber supply analysis. In such cases I will not discuss my considerations in detail in this document, other than to note my agreement with the approach that is already documented in the timber supply analysis report. For some factors, however, I may be satisfied that the assumptions were appropriately modelled in the analysis but choose to discuss them in this document for other reasons, such as a high level of public input, lack of clarity in the analysis report, or concerns resulting from the previous determination for the Revelstoke TSA.

I am aware that there were specific considerations consistent with current timber supply review policies which led to the choice of the 2004 base case forecast. These considerations included the long-term maintenance of stable growing stock on the timber harvesting land base. I have considered the reasoning used to select the base case harvest forecast and I am satisfied with the forecast selected. The alternative harvest forecasts that were considered are discussed later in this document.

I have also considered all public input received on the data package and analysis report, and where appropriate I discuss this input in my considerations under the various factors presented in this rationale.

Consideration of Factors as Required by Section 8 of the *Forest Act*

Section 8 (8)

In determining an allowable annual cut under this section the chief forester, despite anything to the contrary in an agreement listed in section 12, must consider

(a) the rate of timber production that may be sustained on the area, taking into account

(i) the composition of the forest and its expected rate of growth on the area

Land base contributing to timber harvest

- general comments

The total area of the Revelstoke TSA as indicated by the inventory file used in the analysis is 549 420 hectares. About 222 822 hectares (41 percent) of this area is managed by the B.C. Forest Service. Exclusion of non-commercial cover area and productive land lost to roads, trails and landings in the analysis results in a Crown productive forest land base of 220 899 hectares.

As part of the process used to define the timber harvesting land base (i.e., the land base estimated to be economically and biologically available for harvesting), a series of deductions were made from the productive forest land base. These deductions account for the factors that effectively reduce the suitability or availability of the productive forest area for economic or ecological reasons. In timber supply analysis, assumptions, and if necessary, projections, must be made about these factors prior to quantifying the appropriate amount of area to be deducted from the productive forest in order to derive the timber harvesting land base.

Following the deductions, the current timber harvesting land base for the Revelstoke TSA was estimated to be 78 018 hectares, or about 35 percent of the productive forest area, and about 14 percent of the total area in the TSA.

The estimation of the 2004 timber harvesting land base is about 14 500 hectares larger than assumed in the 1998 timber supply analysis, largely as a result of refined methodologies to account for environmentally sensitive areas, productive land lost to roads, and problem forest types.

I have reviewed all of the deductions applied in the derivation of the timber harvesting land base for the Revelstoke TSA. Those factors associated with the derivation of the timber harvesting land base for which, based on my thorough review, I accept the assumptions applied in the analysis, are not discussed in this document. Such factors include the accounting in the analysis for roads, trails and landings, sites with low timber growing potential, timber licences, archaeological areas and woodlot licences.

I note that where my consideration of the information has identified a factor which in my estimation requires discussion in this document, it is described below.

- physical and economic operability

Forest stands in those portions of the TSA which are neither physically operable nor economically feasible to harvest are categorized as inoperable, and are excluded when deriving the timber harvesting land base.

Operability in the Revelstoke TSA has been reviewed several times in an attempt to better define the operable land base. Areas available for timber harvesting in the TSA are limited by the steep and unstable terrain, environmental sensitivity, avalanche hazard, inaccessibility, and poor quality higher elevation stand types. Historically, the operable land base has been defined using primarily physical criteria. A 1994 operability line forms the basis for the application of specific forest cover objectives, including those for caribou, under the Minister's Advisory Committee (MAC) recommendations, as discussed later in this document under the appropriate factors. The operability information was reviewed again in preparation for the 1998 timber supply analysis. In the 1998 analysis, the area excluded as inoperable was about 120 000 hectares, with a geographically specific area (Greeley Creek) and additional unmerchantable forest type exclusions made separately. At that time, district staff expressed some concern that the operable land base may have been overestimated. The 1998 determination included an accounting by the chief forester for an additional 4000 hectares of timber harvesting land base expected to be inoperable, and an instruction that *'in preparation for the next timber supply analysis, the district should annually monitor operability to reduce uncertainty regarding the size of the timber harvesting land base'.*

In 1999, a new operability line was established, and this line was further reviewed by district staff in 2001/2002. The revised operability line included an assessment of timber quality and harvesting economics. A number of stands, primarily hemlock-leading, considered to be marginally economic for harvest (unmerchantable forest types) were classified and excluded as inoperable.

As an additional source of information, staff assessed current forest development plans (FDPs) during the preparation of information for the analysis. It was noted that a number of stands identified as 'Category A' blocks were located outside the area defined as the operable land base. These areas were reviewed by landscape unit and proportions of them were considered to be operable for the purposes of the analysis.

In total, about 129 000 hectares were excluded in the 2004 analysis as inoperable.

District staff are satisfied that the 2001/2002 operability line provided a reasonable assessment of operability in the TSA. However, they express concern about the harvesting potential under current market conditions of many of the higher elevation hemlock-leading stands, and also of the stands in specific inventory type groups (ITGs 12, 18 and 19) that were excluded from the timber harvesting land base in the previous

analysis. I will discuss these concerns and my considerations of the information under *unmerchantable forest types*.

Having recently flown over portions of the Revelstoke TSA, I am aware of the challenges associated with the definition of an operable land base for timber harvesting in such mountainous terrain. However, I noted that recent harvesting by licensees indicates that they are successfully accessing areas at the limits of what is considered operable. Overall, having considered the information presented regarding the operable land base in the Revelstoke TSA, I am satisfied that the assumptions in the analysis have appropriately accounted for physically and economically inoperable areas (with the exception noted above, to be discussed under *unmerchantable forest types*). I therefore make no adjustments on this account in this determination.

I ask that district staff continue to monitor harvesting performance against the defined operable land base. Any new information or assessments can be incorporated into the next determination.

- Mount Mackenzie ski resort development

The development of a destination ski resort at Mount Mackenzie, located just south-east of Revelstoke, has been contemplated for nearly 20 years. Recently, plans have been more seriously considered. A Master Plan was conditionally approved early in 2004 and field work to locate ski lifts and runs has taken place. The Ski Hill Master Development Agreement, representing the contract between the Province of British Columbia and the ski resort developer, has been signed.

District staff estimate that the footprint of the ski development comprises 5160 hectares of Crown productive forest in the Revelstoke TSA, of which 1960 hectares is estimated to be timber harvesting land base. This correlates to a 2.5 percent reduction in the size of the timber harvesting land base.

As part of the timber supply analysis, a sensitivity analysis was completed in which an equivalent amount of area in the two affected landscape units (Alkolkolex and Illecillewaet, corresponding to R3 and R20) was excluded from the timber harvesting land base. The excluded area was assumed to still be available to contribute to landscape level biodiversity objectives, as this would be expected to be the case operationally. The results indicated that an initial harvest level approximately 2.6 percent below the base case projection would be required to reflect the land base withdrawal. Under an alternative harvest flow, it would have been possible to maintain the initial harvest level for two decades before declining to a mid-term level 5.5 percent lower than that of the base case. In the long term, the harvest level would be 2.5 percent lower.

Having considered the information, I am satisfied that it is appropriate in this determination to account for the permanent removal of the land base associated with the Mount Mackenzie ski resort development and the reduction in the timber supply for the TSA. I do note that a volume of wood, estimated by district staff to be in the range of

200 000 cubic metres over the expected 20-year build out of the resort, will likely be harvested from the area, which will comprise a one-time volume contribution to the timber supply in the TSA. My considerations of this information are discussed further under 'Reasons for decision'.

- environmentally sensitive areas

Environmentally sensitive area (ESA) data identify areas sensitive to disturbance due to soil conditions, prone to avalanches, difficult to regenerate and/or with significant value for wildlife or recreation resources. ESA classifications of E1 (highly sensitive) or E2 (moderately sensitive) may be used in timber supply analyses to exclude areas from the land base where more specific or detailed information is not available about a particular forest resource.

Terrain stability data (level D mapping) is available for some portions of the Revelstoke TSA and it was evaluated for use in the timber supply analysis. However, district staff determined that the information would not provide a reliable assessment of areas unavailable for harvest for use in the analysis, because of its lack of standardization. Different classification systems had been used in the level D mapping over the years. Conversely, the ESA classification of areas had been done by one classifier and it was thus considered to be consistent.

The forest cover inventory file for the Revelstoke TSA was rolled over to the Vegetation Resources Inventory (VRI) standards and no longer contains the ESA data. Therefore, the ESA data from the 2000 vintage forest cover files was incorporated into the file used in the analysis.

A refined methodology was used in the 2004 analysis to exclude environmentally sensitive areas. Staff reviewed mapping, forest development plan (FDP) data, and data on current harvesting operations to develop the appropriate exclusions. Staff applied reductions to account for areas prone to avalanche and with highly sensitive soils ESAs only, as areas classified under the ESA system for other resource values (such as wildlife, water, recreation) were accounted for using other methods such as forest cover requirements in the timber supply analysis (as discussed under the appropriate sections of this document).

All areas identified as prone to avalanche were excluded from the timber harvesting land base. For areas with highly sensitive soils, a 60 percent slope class was used to determine the proportion of area to exclude. Areas with highly sensitive soils were entirely excluded on slopes greater than 60 percent, and one quarter excluded on slopes less than 60 percent.

About 39 800 hectares of Crown productive forest are mapped as having highly sensitive soils or as prone to avalanche. The total area excluded following other deductions (such as those for operability) in the analysis was 4388 hectares. A total of 5535 hectares with

highly sensitive soils remain in the timber harvesting land base. The vast majority of these areas (about 92 percent) are located on slopes less than 60 percent.

There are also 4082 hectares of areas with moderately sensitive soils (Es2) in the timber harvesting land base. In his 1999 determination, the chief forester stated that *'...staff should re-examine areas classified as moderately sensitive to ensure they are appropriately accounted for in the next analysis'*. District staff reviewed these in the context of the new methodology described above for soils, and indicate that harvesting operations are not limited on Es2 areas. Therefore, no reductions were applied in this analysis for moderately sensitive soils.

Overall, district staff believe that the assumptions in the analysis reasonably reflect areas likely to be restricted from harvest as a result of sensitive or unstable soils.

In his 2004 determination for the adjacent Golden TSA, the previous chief forester indicated that terrain stability mapping is typically a better tool to determine sensitive soil reductions. In light of this, staff re-examined the available terrain stability data for the Revelstoke TSA. District staff again confirmed that that the terrain stability assessments were completed at different times with different hazard standards, resulting in a lack of consistency which made the data very difficult to use. Input received from Bell Pole Company Limited referred to a G.I.S. review conducted by its staff, in which data from terrain stability level B mapping was compared to ESA mapping. The licensee's results suggested that only about one-third of areas classified as Es1 were considered class 5 (unstable) and unavailable for timber harvesting. The licensee further noted that many approved cutblocks overlap with Es1 as well as Es2 areas.

District staff advise that it may be useful to conduct a detailed data review to determine if any correlations can be drawn between the terrain stability hazard classes and the ESA data, preferably using more detailed data than the Level D mapping. Staff note that areas found to have unstable soils through level A terrain assessments are not currently being captured digitally in the inventory.

Having considered the information regarding environmentally sensitive areas, I am satisfied that it was appropriate to use the ESA data to account for areas with soils or avalanche concerns only, given the accounting made in the analysis elsewhere for the other resource values as discussed under the appropriate factors. Specifically with respect to the soils exclusions, I consider that the assumptions in the analysis have adequately accounted for the areas expected to be restricted from harvesting for soil sensitivity or stability concerns.

However, prior to the next determination, I request that district staff work with licensee staff to review and rationalize the available data for soils, and if necessary refine the assessment of areas restricted from timber harvest for sensitive soils considerations.

- unmerchantable forest types

Unmerchantable ('problem') forest types are defined as areas of stands that are physically accessible and exceed the low site productivity criteria, yet are not currently utilized.

Historically in the Revelstoke TSA stands with high proportions of hemlock and subalpine fir (balsam) with little spruce have been of marginal merchantability. In the previous analysis for the TSA, all stands 140 years of age and older in inventory type groups (ITGs) 12 (pure hemlock), 18 (pure balsam) and 19 (balsam hemlock) were excluded from the timber harvesting land base. At that time, all deciduous stands were also excluded, for a total exclusion of 4870 hectares. In his 1999 determination, the chief forester stated that '*the district should continue to review the utilization of problem forest types to realistically assess their contribution to timber supply*'.

In the 2004 analysis, deciduous-leading stands were excluded, but only those over 15 years of age, as the younger stands were assumed to be rehabilitated to coniferous-leading stands. In addition, all hemlock-leading stands with a deciduous component (ITG 17) were excluded. However, staff believed that the refinement of the operability information in 2001/2002 had already resulted in the exclusion of most of the stands with a high proportion of hemlock. Staff reviewed harvesting performance in these stands, and found the results to be consistent with the percentage of those stands in the newly defined operable land base. As a result, further deductions to specifically account for unmerchantable hemlock stands were not made in the 2004 analysis. The total exclusion for unmerchantable forest types in the 2004 analysis was 2828 hectares.

Following completion of the analysis, staff noted that for ITG 17 stands, only those stands older than 140 years of age are considered unmerchantable. As a result, about 400 hectares of the younger stands should have been retained in the timber harvesting land base.

In preparation for the determination meeting, district staff reviewed the analysis assumptions regarding non-merchantable forest types. They note that market conditions have decreased the merchantability of hemlock in the Revelstoke TSA. About 20 000 hectares, or 26 percent, of the timber harvesting land base in the Revelstoke TSA is comprised of hemlock-leading stands older than 140 years of age. Mountain hemlock in particular contains a high proportion of rot and is primarily only marketable for pulp, which is shipped out of the TSA. Pulp markets have been unstable over the past few years. Stands typically must contain a certain proportion of other higher value species (e.g., cedar or spruce) in order to be merchantable, and staff note that the reduction in cedar prices has exacerbated the issues around harvesting high-proportion hemlock stands. As a result, district staff are concerned that fewer stands are merchantable than were assumed in the analysis.

The first consideration is whether stands with a high proportion of hemlock should be excluded from the timber harvesting land base. About 15 000 hectares of stands on the timber harvesting land base over 140 years of age contain more than 59 percent hemlock

by volume. About 4500 hectares of these stands contain more than 79 percent hemlock by volume.

Staff reviewed current harvesting performance in comparison to the profile of stands on the timber harvesting land base. Their review included conducting a comparison of inventory volumes and cruise volumes. The cruise data suggested that stands with a high ratio of hemlock stems are not being harvested at a rate in proportion to their contribution to the inventory.

Licensee staff questioned the use of cruise volumes to reflect logged inventory volumes, stating that in general cutting permits identified in cruise data have significantly fewer timber types than indicated by the inventory because timber types are blended. Downie Sawmills conducted a G.I.S. exercise in which it was shown that the licensee had performed well in hemlock forest types based on the inventory of blocks harvested over a six-year period between January 1999 and December 2004. District staff reviewed the licensee's analysis and substantiated its findings. The licensee also notes a recent trend to process more white wood species (such as hemlock) in its mill.

I note that older hemlock and balsam stands typically provide the attributes of good caribou habitat. Staff note that it is possible that the percentage contribution to the harvest from these types is lower than what is present in the inventory because these stand types tend to be set aside to meet caribou or other habitat objectives. Parks Canada submitted input supporting the use of larger land base exclusions for unmerchantable forest types to meet caribou recovery objectives.

If it were appropriate to assume that all stands with more than 79 percent hemlock stems were unharvestable, the result of a sensitivity analysis conducted as part of the published analysis report provides an assessment of the implications to timber supply. In this analysis, an equivalent amount of area (4500 hectares) was excluded from the hemlock-leading analysis units. The results indicate that timber supply would be affected across all time horizons. An initial harvest level ten percent below that of the base case – 207 000 cubic metres per year – was attainable for a single decade before declining.

A second consideration is whether the exclusions applied in the previous analysis – of stands older than 140 years of age in ITGs 12, 18 and 19 – should have been applied in the 2004 analysis. These stands are comprised of more than 80 percent balsam or hemlock and are considered to be the least productive of the marginal stands. About 2230 hectares of these stands remain in the timber harvesting land base; about 1600 hectares of them are within ITG 12 and overlap with the stands containing more than 79 percent hemlock noted above. Harvesting performance in the predominantly balsam stands has been poor, addressing less than one third of the profile. Licensee staff agree that the majority of the ITG 18 and 19 stands should likely be excluded as unmerchantable. Staff from Downie Street Sawmills, however, note that harvesting performance in ITG 12 stands has been demonstrated, and further that these stands provide good caribou habitat and are often selected for retention on that basis.

I have considered the information regarding unmerchantable forest types in the Revelstoke TSA and I make the following observations. With respect to the area of stands with more than 79 percent hemlock by volume, I note that harvesting performance would indicate that the profile of those stands, while not entirely represented in harvested blocks, is indeed being demonstrated, and that these stands are not being avoided. I therefore would consider it inappropriate to exclude all of these stands from the timber harvesting land base. This brings me to consideration of the least merchantable of the stands – those within ITG 12, and the similarly marginal balsam and hemlock stands from ITGs 18 and 19. These stands, with the highest proportion of hemlock stems and highest proportion of balsam stems appear to be the most problematic, and according to my review of the information, are not being harvested to any appreciable extent. I am therefore satisfied that it is appropriate based on the information provided to exclude all stands within ITGs 18 and 19 as unmerchantable.

However, I am aware that reasonable harvesting performance has been demonstrated in pure hemlock stands (ITG 12). These stands also offer good attributes of caribou habitat, and may be selected for retention for that purpose. I note that the 2004 analysis included an accounting for levels of stand retention to meet caribou habitat objectives (as discussed later in this document under *landscape level biodiversity*), and therefore retention of these stands for caribou habitat has already been accounted for in the analysis. It would therefore be inappropriate to exclude them entirely from the timber harvesting land base on this basis.

In consideration of all of the information presented, I conclude that it is appropriate to account for the exclusion of all pure balsam and balsam-hemlock stands (ITGs 18 and 19), and half of the pure hemlock stands (ITG 12), for a total of about 1400 hectares. I will also account for the addition of 400 hectares of hemlock-deciduous (ITG 17) stands that were inappropriately excluded. I will discuss my considerations of these adjustments and the implications for timber supply further in 'Reasons for Decision'.

I request that BCFS and licensee staff continue to monitor harvesting performance in these stands over the next five-year period in order to ensure that the assumptions around merchantability are a reflection of true operational conditions in the TSA. In addition, I request monitoring of the level to which unmerchantable forest types are selected to contribute to other forest cover objectives, such as for caribou habitat.

- protected areas

In the 2004 timber supply analysis, existing parks within the TSA were appropriately excluded from contributing to the timber harvesting land base. These areas include Mt. Revelstoke National Park, which is encompassed by the TSA and Glacier National Park, which borders the eastern boundary of the TSA.

I note that while parks do not contribute to the timber harvesting land base, they do contribute to the achievement of landscape biodiversity objectives (as discussed later in this document under *landscape-level biodiversity)*. Timber supply analysis assumptions

are typically developed so as to enable the forested portions of parks to contribute to the meeting of objectives. In the analysis for the Revelstoke TSA, however, I am aware that the forested portion of parks were inadvertently excluded from the analysis area. The implications of this omission are discussed later in this document under *landscape-level biodiversity*.

Existing forest inventory

- current inventory

The forest cover inventory data used for the 2004 analysis was based on aerial photos taken in 1991 and 1992. This information has been updated for harvesting and silviculture activities to October 1999. In 2001 the forest cover (FC1) files were converted to a vegetation resources inventory (VRI) format. However, no phase 1 or phase 2 VRI sampling has yet taken place.

I am aware that the time of this determination is already several years into the first decade I am mindful of this timing in my consideration of a harvest level for the Revelstoke TSA.

For the analysis, the 2001 forest development plan (FDP) data was incorporated into the file, providing information on blocks harvested to 2000, as well as current Category A blocks. Some stands which would otherwise have not been included in the timber harvesting land base (for operability or other reasons) were retained because of their Category A designation.

The data file for the Revelstoke TSA indicates that the total TSA area is approximately 48 000 hectares larger than assumed in the previous analysis. This increase in size since the previous analysis results primarily from three factors: the refinement of TSA boundaries to TRIM heights of land, re-mapping of two areas previously excluded from the TSA, and reconciliation of the TSA and district boundaries. The Crown productive forest increased in size by only 1350 hectares compared to the last analysis as a result of timber licence reversions.

An inventory audit, completed in 1994 on the older inventory file for the Revelstoke TSA, was recompiled to enable comparison to the VRI file data used in the analysis. The implications of the audit findings will be discussed below under *'volume estimates for existing stands'*.

I have reviewed the information regarding the species profile and the age class distribution of stands in the Revelstoke TSA. Apart from my considerations as discussed previously under *unmerchantable forest types* related to the harvesting performance across the species profile (particularly hemlock- and balsam-dominated stands), I accept this information and I will not discuss it further in this document.

- volume estimates for existing stands

In the timber supply analysis, volumes for existing unmanaged stands were estimated using the attributes in the forest inventory file and the Variable Density Yield Prediction (VDYP) growth and yield model (version 6.5a). This version of VDYP used Forest Inventory Zone (FIZ)-based decay, waste and breakage factors in the estimation of volumes. Volumes for backlog NSR stands were also estimated using VDYP as it was assumed that such stands had attributes more like those of unmanaged stands.

District staff have identified no specific concerns regarding the volumes estimates for unmanaged stands.

A forest inventory audit was conducted on the older forest inventory in 1994. When the forest inventory file was converted to VRI standards the audit results could no longer be directly compared to the file data. The audit data was restratified in 2002 based on the new VRI polygons to enable the audit ground data to be compared to the inventory file data. No new audit plot data was collected. The restratified audit data was recompiled using the older FIZ-based loss factors (as were used in the analysis), as well as using the newer biogeoclimatic (BEC)-based loss factors, which will be available in future releases of the VDYP model.

BCFS staff note that the audit methodology was less rigorous than that applied in the provincial VRI phase 2 ground sampling and therefore the results of the audit should be viewed with some caution.

The audit results of most relevance to this determination are those associated with stands more than 60 years of age on the operable land base. Although not considered statistically significant, the audit results suggested that the volumes derived from the inventory attributes may be overestimated. The volumes derived in the audit were between 8 and 10 percent lower than those calculated using the inventory attributes. Although decay, waste and breakage were estimated using both BEC- and FIZ-based loss factors in the audit, the different factors accounted for much less than a one percent difference in volumes.

Input from Bell Pole questioned the use of FIZ-based loss factors in the volume estimations, noting that the BEC-based factors are believed to provide a better estimate of losses. I agree with their observation but note that versions of VDYP incorporating the BEC-based factors are not yet available for use. In reviewing the audit results, I note that use of BEC- or FIZ-based factors made very little difference to the estimated audit volumes and I consider the risk to timber supply to be insignificant as a result of having assumed losses in the analysis based on FIZ factors. I discuss the loss factors further under *decay, waste and breakage*.

I have considered the information about the volumes for existing stands in the Revelstoke TSA. I am aware that sensitivity analysis to evaluate the timber supply implications if stand volumes were overestimated by 10 percent indicates that the

short-term harvest level would need to be reduced by as much as 10 percent. However, in reviewing the available information, I cannot conclude that volumes for existing stands are indeed overestimated. Former Ministry of Sustainable Resources Management specialists (now in the Ministry of Forests and Range) indicate that the size of the audit dataset did not permit further stratification to determine if the uncertainty could be correlated in any way to a particular species or age class. The audit was originally performed against an earlier inventory file and had been restratified to enable comparison to the current file, further contributing to uncertainty around the results. The distinction between operable and inoperable area made in the audit was based on the 1994 operability for the TSA. As this differs from the currently defined operable land base, the pool of audit data for operable stands over 60 years of age may no longer correlate well (the audit suggested that volumes estimated for forests on the total productive forested land base were acceptable). Additionally, there is reduced rigour attached to the audit plots relative to a phase I or phase II vegetation inventory. All of these factors make it difficult to draw conclusions about the audit results.

Having reviewed this information, I conclude that too much uncertainty currently exists to decide whether existing stand volumes are indeed overestimated. Given that the implication of overestimates in existing stand volumes includes a possible reduction in short-term timber supplies, this particular source of uncertainty needs to be resolved. The possible data that could reduce the uncertainty associated with this issue would be the completion of a VRI phase II inventory. Therefore, I request that the appropriate specialists from the BCFS and the former MSRM collaborate with licensee staff to undertake a phase II vegetation inventory prior to the next determination for the Revelstoke TSA.

For this determination, I accept that the best available information was used in the analysis, and make no adjustments on this account. However, I will discuss the uncertainty around this factor further under 'Reasons for decision'.

Expected rate of growth

I have considered the information regarding minimum harvestable ages assumed in the analysis for the Revelstoke TSA, and I accept them for use in this determination. Therefore I will not include any further discussion in this document.

- site productivity estimates

Inventory data includes estimates of site productivity for each forest stand, expressed in terms of a site index. For a given stand, the site index is based on the height of the stand as a function of its age. The productivity of a site largely determines how quickly trees grow. This in turn affects the time seedlings will take to reach green-up conditions, the volume of timber that can be produced, and the ages at which a stand will satisfy mature forest cover requirements and reach a merchantable size.

In the base case for the 2004 timber supply analysis, the site index estimates provided in the forest inventory file were used to determine appropriate yield curves for stands. It is generally believed that the productivity of sites currently occupied by old growth stands is underestimated by the old growth site indices, and greater stand productivity is possible when these sites are regenerated. In general, the most accurate measurement of site productivity is provided by stands between 30 and 150 years of age. Site indices determined from younger stands (i.e. less than 31 years old), and older stands (i.e. over 150 years old) are the most likely to not accurately reflect potential site productivity. In young stands, growth often depends as much on recent weather, stocking density and competition from other vegetation, as it does on site quality. In older stands, which have not been subject to management of stocking density, the trees used to measure site productivity may have grown under intense competition or may have been damaged, and therefore may not reflect the true growing potential of the site. This has been verified in studies such as the old-growth site index (OGSI) project which indicate that actual site indices may be higher than those indicated by existing data from mature forests.

The implications to timber supply in this TSA if the site productivity for older stands is indeed underestimated were assessed in sensitivity analysis. Stands older than 140 years of age occupy 50 percent of the timber harvesting land base in the TSA. No local site productivity studies have been done in the TSA, and therefore the results of two provincial Old Growth Site Index (OGSI) studies were used to estimate adjustments, both of which are documented in *Information sources used in this AAC determination*.

The paired plot study results indicated that site indices calculated from old growth Douglas-fir, lodgepole pine and interior spruce stands underestimate potential site productivity. Site indices for the old growth spruce-leading stands in the Revelstoke TSA were adjusted by the amounts suggested by the study. The sensitivity analysis results indicate that if site productivities for the spruce stands in the TSA were indeed underestimated by the amount suggested in the paired plot study, long-term timber supply could be 2.6 percent greater. Short- and mid-term timber supplies were unaffected. Timber supply is not greatly increased because old growth spruce-leading stands occupy a relatively small proportion of the timber harvesting land base, and the majority of these stands are on sites with good site productivity, which are subject to smaller average adjustments. Site productivities for good sites is not expected to be as greatly underestimated as those for medium or poor sites.

The veteran tree study results indicated that site indices calculated from all old growth stands underestimate site productivity. The suggested adjustments are considered less reliable than those from the paired plot study due to the methodology of the study. The adjustments were applied to the site indices of all the old growth stands in the TSA in the second sensitivity analysis. The results indicate that if the provincial adjustments were applicable to the stands in the Revelstoke TSA, both mid- and long-term timber supply could be greater. The mid-term timber supply could be 6.7 percent above that in the base case, and long-term timber supply could be 19.1 percent higher than projected in the base case.

I have reviewed the information and the results of the sensitivity analysis. I am satisfied from my own knowledge and observations in other areas of the province that site productivity is underestimated for the majority of sites occupied by old growth stands. What remains uncertain, however, is the extent to which productivity is underestimated for the stands in the Revelstoke TSA. Old growth stands currently occupy over half of the timber harvesting land base in the TSA. The sensitivity analysis results give an indication of the timber supply implications if the provincial study adjustments were to be applicable to these stands. However, local data is needed in order to more precisely determine what adjustment might be appropriate. For this determination, I will take into account the likelihood that site productivity is underestimated, by an uncertain amount, and that timber supply is greater in the mid- to long-term than shown in the base case. I will discuss my considerations further under 'Reasons for Decision'.

I request that as time and resources are available, district and licensee staff work to attain local data that would better quantify the timber supply implications of the potential underestimate in old growth site productivity.

- volume estimates for regenerated stands

The Table Interpolation Program for Stand Yields (TIPSY) was used to estimate volumes for existing and future managed stands. Volume predictions using TIPSY assume management of stocking density, full site occupancy and absence of significant brush competition. In the 2004 analysis, all existing stands aged 25 years or less (with the exception of backlog NSR stands) were assumed to be managed. Volumes for these stands and all stands regenerated in the future were estimated using TIPSY version 3.2.

I have reviewed the information regarding the assumptions used to estimate the volumes for managed stands, and I am satisfied that what was done in the analysis was appropriate. However, I discuss my consideration of two aspects affecting managed stand yield estimates below:

i) operational adjustment factors

Operational Adjustment Factors (OAFs) are applied in TIPSY to account for losses of timber volume due to unmapped stand openings (OAF1), as well as for age-dependent factors such as pests, disease, decay, waste and breakage (OAF2).

In the 2004 analysis, the standard provincial reductions of 15 percent for OAF1 and 5 percent for OAF2 were applied. District staff note that no data has been collected to review the applicability of the standard provincial OAF values to stands in the Revelstoke TSA. In recent determinations for some management units in the Southern Interior Region, additional accounting for losses from root diseases has been made. However, staff believe that for the stands in the Revelstoke TSA, root disease losses are adequately addressed in the standard values applied.

Bell Pole stated in its input that review of its own free growing data suggests an OAF 1 of 15 percent overestimates losses. The licensee suggested that an OAF 1 value of 0 percent might be better.

BCFS staff note that about 8 percent of the OAF 1 reduction is intended to account for non-productive and non-commercial cover, which would not have been included in the free growing plot data. In consideration of the remaining 7 percent, district staff used a small sample of free growing plots and followed the licensee's methodology. Their assessment suggested that this portion of the OAF 1 value could be reduced to 3.5 percent. However, staff note that the methodology using free growing plot data to refine estimates has not been reviewed by provincial specialists. A formal review might indicate that it could provide a valid means of refining OAF 1 values.

Having considered the information on OAFs, I make the following observations. I acknowledge the licensee for attempting to develop some better local estimates for OAF 1 values. Noting that Bell Pole has requested that the BCFS participate in a study to determine how the available data may be used in a credible way to refine OAF values, I encourage the undertaking of such a project. For this determination, I accept that the best available information was used to determine OAF 1 values and I make no adjustments in this regard.

With respect to OAF 2 estimates, I am aware that it has been found to be appropriate in some of the other management units in the southern interior to increase OAF 2 values, in order to account for the impacts of root diseases on the future growth of managed stands. This uncertainty was also noted by Bell Pole in its public input. The root diseases under consideration primarily affect Douglas-fir leading stands, and I acknowledge that these stands are not that numerous in this TSA. I accept district staff's assessment that the standard provincial OAF 2 values are reasonable for the Revelstoke TSA, and I make no adjustments on this account. I request that this issue continue to be monitored so that any new information can be incorporated into future analyses.

ii) the use of select seed

Class A (select) seed is used when available for reforestation in the Revelstoke TSA. Interior spruce makes up the majority of available seed. Larch, western white and lodgepole pine are also being used for planting in the TSA, but to a much lesser extent.

Genetic gain values, which provide a percentage volume increase expected at rotation age, are available for class A seed. A value for the seed in current use, as well as a value for seed expected to become available in the near future, are provided by BCFS Tree Improvement Branch staff.

In the base case of the 2004 analysis, a genetic gain value of 3.8 percent was assumed for spruce based on the select seed currently available, and this value was incorporated into managed stand yield curves. No volume increases were modelled to reflect the use of larch, lodgepole or western white pine select seed due to the small amount of seed in use.

Future genetic gain values are available for spruce and Douglas-fir seed. A sensitivity analysis was conducted to assess the timber supply implications if these future genetic gains were to apply to all Douglas-fir and spruce seedlings planted, beginning one decade into the planning horizon. Corresponding adjustments were also made to the minimum harvestable ages and estimated ages to reach green-up for these stands. The results indicated that the long-term timber supply could be up to 3.5 percent greater than projected in the base case on this account.

Having reviewed the assumptions regarding select seed use in the TSA, I am satisfied that the analysis has appropriately reflected current operational practices. I am mindful that the timber supply in the long term could be greater than projected in the base case harvest forecast if the tree improvement program is able to deliver improved seed with the genetic gain values expected. I discuss this further under 'Reasons for decision'.

As the development of this seed continues and it becomes available for use, any revised information about volume gains will be incorporated into future analyses.

(ii) the expected time that it will take the forest to become re-established on the area following denudation:

Regeneration delay and impediments to prompt regeneration

I have been presented with information regarding the regeneration delays and impediments to prompt regeneration in the Revelstoke TSA, and the assumptions regarding these that were applied in the analysis. I am satisfied that the analysis assumptions appropriately reflect current operational conditions and I will not discuss these any further in this document.

Not-satisfactorily-restocked areas

Not-satisfactorily-restocked (NSR) areas are those where timber has been removed, either by harvesting or by natural causes, and a stand of suitable forest species and stocking has yet to be established. Areas where the standard regeneration delay has not yet elapsed since being harvested are considered 'current' NSR. Where a suitable stand has not been regenerated and the site was harvested prior to 1987, the classification is "backlog" NSR.

In the 1999 TSR 2 determination, the Chief Forester requested that *'prior to the next determination, staff should reassess the areas classified as current and backlog NSR'*. This request was made due to some identified uncertainties about the amount of area classified as current NSR versus backlog NSR.

In the preparation of data for the analysis, staff reviewed NSR records on the forest inventory file as well as the silviculture information systems – the Integrated Silviculture Information System (ISIS) and the Major Licensee Silviculture Information System (MLSIS). Areas classified as 'type id 4' or 'type id 9' on the inventory file correlate to NSR; these areas on the timber harvesting land base totalled 3210 hectares. The ISIS and MLSIS records indicated current NSR of 795 hectares and backlog NSR of

1850 hectares, for a total of 2645 hectares. Because information about NSR that becomes restocked is updated in ISIS and MLSIS more quickly than in the inventory file, staff assumed that the latter area was more accurate. The excess hectares labelled NSR in the inventory file were assumed to be already restocked and was assigned an age of 5 years in the analysis. However, the species compositions indicated on the inventory file for the NSR stands were assumed to be accurate and were used in the analysis.

Areas classified as current NSR are expected to regenerate as managed stands following regeneration delay. In the analysis, these areas were assigned an age of 0 years and retained the current species composition on the file. The youngest stands in type id 4 or 9 were assumed to be current NSR, for a total of about 800 hectares.

Areas classified as backlog NSR are assumed to be older stands for which regeneration has been either impeded or unmanaged, and that as a result have reduced stocking. Those stands older than 11 years of age in type id 4 or 9 in the inventory file were assigned to specific yield curves, and volumes projected using VDYP ('unmanaged' stands) using a volume adjustment factor to account for the reduced stocking. The stands were divided into two groups, in an attempt to reflect differences in management regime and expected yields: stands with more than, or less than, 60 percent of the minimum stocking standard. The file did not contain information to enable stocking differentiation for stands, so the areas were randomly assigned to either stocking class. Following the first rotation and harvest, these stands were regenerated on managed stand yield curves. In the analysis, about 700 hectares were assumed to have less than 60 percent stocking, and the remaining area to have more than 60 percent stocking.

In preparation for the determination meeting, district staff further examined the information on NSR and the assumptions applied in the analysis. They indicate that the excess area labelled as NSR on the inventory file may actually be associated with older burns and may have lower stocking than was assumed in the analysis for the first rotation. Staff suggest these stands should have been included with the backlog stands with less than 60 percent of the minimum stocking standard.

In addition, staff note that about 620 hectares of timber harvesting land base were burned during the 2003 wildfires. About 105 hectares of this area were existing plantations and will be replanted. The remaining 515 hectares are not expected to be salvage harvested or rehabilitated, and will likely be reclassified to backlog NSR with stocking less than 60 percent of the minimum stocking standard.

In consideration of this information, I note the following implications. Just under 1200 hectares, or 1.5 percent, of the timber harvesting land base occupied by stands of varied ages may have sparser stocking and therefore lower volumes than assumed in the analysis for the first rotation. A review of the yield curves for the lower stocked stands indicates to me that the volume implications are actually very minimal. I will nevertheless discuss this in 'Reasons for Decision'.

I request that BCFS and licensee staff work to further rationalize NSR records as time and resources permit, so that the best available information can be used in future determinations for the Revelstoke TSA.

(iii) silvicultural treatments to be applied to the area:

Silvicultural systems

About 5 percent of the harvest in the Revelstoke TSA is through the use of alternative silvicultural systems, such as patch and group selection. The majority of the harvest is through the use of even-aged (clearcut, clearcut with reserves) silvicultural systems. District staff indicate that alternative systems are primarily in use to address caribou habitat requirements. Use of alternative systems to meet these objectives may increase in the future.

Only even-aged systems were assumed in the timber supply analysis. Yield tables were derived assuming even-aged management, and a land base reduction was applied to account for wildlife tree retention in harvested blocks (as discussed under *stand level biodiversity*).

I have considered the assumptions regarding silvicultural systems in the analysis, and I am satisfied that they reasonably reflect current practice. Should the use of alternative systems increase over time, it can be reflected in future determinations. For this determination, I am satisfied that current practices were adequately represented in the analysis and I make no adjustments.

Rehabilitation programs

No rehabilitation programs are currently being conducted in the Revelstoke TSA. District staff note that the stands on the timber harvesting land base that were burned in the 2003 wildfires, and that are not scheduled to be salvaged, would be candidates for rehabilitation if funding were to become available.

My considerations of the impact of the loss of 500 hectares of timber harvesting land base was discussed earlier in this document under Not-satisfactorily-restocked areas. Having considered the information about rehabilitation programs in the TSA, I am satisfied that there are no issues that would affect this determination.

Incremental silviculture

Incremental silviculture includes activities such as commercial thinning, juvenile spacing, pruning, and fertilization that are not part of the basic silviculture activities required to establish a free-growing forest stand.

Very few incremental silvicultural activities are currently being conducted in the Revelstoke TSA. Staff note that little funding has been available for these activities over the past few years.

Having considered the information regarding incremental silviculture activities, I am satisfied that the analysis assumptions were appropriate and there are no issues that would affect this determination.

(iv) the standard of timber utilization and the allowance for decay, waste and breakage expected to be applied with respect to timber harvesting on the area:

Utilization standards

Utilization standards define the species, dimensions and quality of trees that must be harvested and removed from an area during harvesting operations. In the analysis for the Revelstoke TSA, the utilization standards assumed for most species were a minimum 17.5-centimetre diameter at breast height (dbh), a 30-centimetre maximum stump height and a minimum 10-centimetre top diameter inside bark. For lodgepole pine stands, a minimum dbh of 12.5 centimetres was assumed.

BCFS district staff indicate that, with one minor exception, the assumptions used in the analysis reflect current utilization standards and current practice in the TSA. For western redcedar stands older than 140 years, the minimum top diameter inside bark standard is actually 15 centimetres. However, the VDYP model used to estimate volumes in the analysis does not support the use of a 15-centimetre top. A study to assess the volume difference between assuming utilization to a 10-centimetre or a 15-centimetre top showed it to be less than one percent.

I accept the assumptions employed in the base case for utilization standards as reasonable and make no adjustments.

Decay, waste and breakage

For managed stands, as previously discussed in *volume estimates for managed stands*, the TIPSY model incorporates OAFs that account for anticipated volume losses as a result of decay, waste and breakage.

For existing natural stands, reduction factors are also applied to volume estimates to reflect the volume lost to decay, waste and breakage. Decay losses are built into the VDYP volume estimates, while standard waste and breakage factors are applied in the analysis when developing VDYP yield curves. These estimates of losses have been developed for different areas of the province based on field samples.

For the Revelstoke TSA, version 6.5a of VDYP was used to estimate natural stand volumes in the analysis, which assumes the Forest Inventory Zone (FIZ)-based loss factors. BEC-based loss factors are now the standard, and the newer version of VDYP when available will use the BEC-based loss factors. The BEC-based factors result in slightly smaller assumed losses for most species than the FIZ-based factors.

Bell Pole noted a number of points related to decay, waste and breakage in its public input. The licensee noted that the chief forester's previous rationale statement that the

new decay, waste and breakage estimates would be incorporated into VDYP for use in this timber supply review. It also requested that I consider the effect of incorporating the BEC-based factors into the existing stand inventory, and that I consider the effect of the new inventory taper and loss equations derived from recent local destructive sampling of cedar and hemlock.

In consultation with staff, I make the following points. Unfortunately, the version of VDYP with the new factors incorporated is not yet available for use, but I am assured that it will be available shortly and the next analysis for this TSA will therefore incorporate these loss factors. With respect to considering the impact of the new inventory taper and loss equations derived from recent local destructive sampling of cedar and hemlock, I am informed that the BEC taper and loss equations for cedar and hemlock for the Revelstoke TSA were adjusted with the local unbiased sampling conducted in 1997. This information was incorporated into the generation of the new BEC-based loss factors, which will be available with the newer versions of VDYP.

I note that I have reviewed the inventory audit information discussed under *volume estimates for existing stands*, in which audit volumes were compiled using both BEC- and FIZ-based factors. The difference in estimated volumes for the audit using the two sets of factors was insignificant (much less than one percent). In consideration of this information, I am satisfied that a reasonable accounting was made for volume losses from decay, waste and breakage in the analysis. I therefore make no adjustments in this determination.

(v) the constraints on the amount of timber produced from the area that reasonably can be expected by use of the area for purposes other than timber production:

Integrated resource management objectives

The Ministry of Forests and Range is required under the *Ministry of Forests Act* to manage, protect and conserve the forest and range resources of the Crown and to plan the use of these resources so that the production of timber and forage, the harvesting of timber, the grazing of livestock and the realization of fisheries, wildlife, water, outdoor recreation and other natural resource values are coordinated and integrated. Accordingly, the extent to which integrated resource management (IRM) objectives for various forest resources and values affect timber supply must be considered in AAC determinations.

Management for non-timber values such as wildlife, water, visual quality and biodiversity involves control of the size and distribution of cutblocks across a landscape, limits on the maximum area of recent harvesting-related disturbance (areas covered by stands of less than a specified height), prescription of minimum green-up heights required for regeneration on harvested areas before adjacent areas may be harvested, and retention of minimum amounts of mature and old-growth forest. Such practices and guidelines ensure that harvesting is not concentrated in a specific area, and that the area of retained forest cover meets objectives for habitat, visual quality and water quality.

The management objectives were modelled in the analysis through the creation of several overlapping management zones to which specific forest cover objectives were applied. About 45 percent of the timber harvesting land base is located in the caribou zone; 29 percent in the ungulate zone; 24 percent in the visual management zone; and 7 percent in domestic or community watershed zones. Areas not otherwise subject to forest cover objectives for specific values were grouped into the IRM zone (about 27 percent of the timber harvesting land base). Objectives for landscape level biodiversity were modelled across the entire forested land base. The specific forest cover objectives assumed in the analysis for wildlife, visual quality, water quality and biodiversity are discussed in corresponding sections later in this rationale.

I have reviewed the information presented to me regarding the analysis assumptions for adjacency and green-up, recreation, grizzly bear habitat, botanical forest products, and archaeological resources and I am satisfied that the analysis has appropriately reflected the operational requirements for these values. I accept this information and I will not discuss it further in this document.

- visually sensitive areas

Careful management of scenic areas along travel corridors and near recreational sites is an important objective. The Code enables the management of visual resources by providing for scenic areas to be identified and made known, and by providing for the establishment of visual quality objectives (VQOs). To achieve these objectives, visual landscape inventories are carried out to identify, classify and record those areas of the province that are visually sensitive. Data from a 2001 visual landscape inventory conducted in the Revelstoke TSA were used to formulate the assumptions in the 2004 timber supply analysis.

VQOs limit the amount of visible disturbance that can occur in sensitive areas. Guidelines to meet VQOs include setting a maximum percentage of a viewshed available for harvesting at any time, and setting 'visually effective green-up' (VEG) heights for adjacent stands. VEG refers to the height at which a stand of reforested timber is perceived by the public to be satisfactorily 'greened-up' from a visual standpoint.

Important scenic areas are located in the Revelstoke TSA primarily along the Trans-Canada highway, Highway 23 south and from the city of Revelstoke. Scenic areas have been formally designated in the Revelstoke TSA, although visual quality objectives have not been legally established. Corresponding visual quality classes (VQCs) have been made known to licensees through forest development plan instructional letters and guide current practice. Just under 2 percent of the timber harvesting land base is subject to retention visual quality; 10.4 percent to partial retention, and 11.6 percent to modification. A total of 18 500 hectares of timber harvesting land base was modelled as visually sensitive.

In the base case of the analysis, visually sensitive polygons were grouped together according to their VQC (retention, partial retention, or modification), and a forest cover

constraint was applied by landscape unit, restricting the amount of area permitted to be covered with stands below a specified green-up height at any one time. The maximum allowable disturbance was modelled at the top of each range of alteration suggested by the guidebook. For retention areas, a maximum of five percent of stands on the area were permitted to be below a VEG height of six metres, and for partial retention areas a maximum of 15 percent of stands were permitted to be below a VEG height of six metres. For modification areas, a maximum of 25 percent of stands were permitted to be below a height of two metres.

The Minister's Advisory Committee recommendations include some guidance for visually sensitive areas. In particular, the plan outlines targets for the amount of the visually sensitive area intended to be within retention, partial retention, and modification visual quality classes (VQCs) for class 1 and class 3 visuals, given key corridors from the highways and the City of Revelstoke. For example, for class 1 visual areas, it is expected that at least 60 percent of the area within 0 to 1 kilometre along the visual corridor will have retention VQCs, at least 60 percent of the area within 1 to 5 kilometres along the corridor will have partial retention VQCs, and at least 60 percent of the area within 5 to 12 kilometres along the corridor will have modification VQCs.

In preparation for the determination meeting, and to answer a query from Bell Pole in public input, district staff conducted additional data analysis. Bell Pole had expressed the opinion that the visual landscape inventory, and thus the assumptions in the analysis, were more constraining to harvesting activities than intended under the Revelstoke and Area Land Use Planning Final Recommendations, in particular for their operating areas. District staff compared data from the visual inventory to the objectives stated under the plan as given in the example above, and found that for the TSA as a whole, the visual landscape inventory was indeed consistent with the intent of the plan.

The BCFS regional landscape forester expressed some concerns regarding how visually sensitive areas were modelled in the analysis. He noted that the modelling methodology – whereby all visually sensitive polygons of one VQC were grouped together within each landscape unit – does not entirely reflect operational considerations. He also suggested that due to the mountainous topography, some areas in the Revelstoke TSA would be likely to have a low visual absorption capacity (VAC), and therefore the disturbance possible operationally while still meeting the intent of the VQO is likely to be less than the maximum alteration percentages. The midpoint of each alteration range was suggested. In addition, he suggested that a VEG height of 2 metres for modification areas is likely to be optimistic, and that 5 metres would be a more realistic guide. Sensitivity analysis in which the allowable disturbance percentages were decreased to the midpoints showed that the initial harvest level could be maintained for only one decade before declining to a mid-term level 5.7 percent lower than the base case. The long-term harvest level was 2.4 percent lower than in the base case.

District staff note that operationally in the TSA, the maximum alteration percentages are currently being used to direct management. Licensees are currently conducting harvesting operations in scenic areas and are meeting the objectives of the visual quality

classes described. District staff concur, however, that a 5-metre VEG height for at least some of the stands in the modification VQC areas is likely appropriate, given the nature of the terrain and the amount of snow received. Staff indicate that the proportion of the area to which a 5 metre instead of a 2 metre VEG height would apply is uncertain.

In considering the information provided regarding visually sensitive areas, I have the following observations. I am satisfied from the information presented that the intent of the Minister's Advisory Committee recommendations, which guides current harvesting operations in the TSA, is well reflected in the timber supply analysis. Based on observations during an overview flight and discussions with district staff, I conclude that licensees are effectively planning harvesting activities in visually sensitive areas and meeting the stated objectives. I acknowledge the comments of the regional landscape forester that a level of disturbance closer to the midpoints may be more appropriate for some areas. However, district staff indicate that this would not reflect current practices in visually sensitive areas. I also note that the land base of the Revelstoke TSA is heavily constrained by requirements to meet other objectives, and I expect that the areas subject to management for visual sensitivity will be managed to the extent of what is possible given the constraints on the rest of the land base.

With regard, however, to the height used to reflect visually effective green-up in areas subject to modification VQCs, I accept the assessment of district staff that for some stands, 5 metres likely more appropriately reflects operational considerations. Modification VQC's apply to about 12 percent of the timber harvesting land base. The impact of adjusting green-up heights from 2 to 5 metres for stands on a portion of these areas was not assessed in a sensitivity analysis. Review of the attributes of stands comprising the modification VQC areas indicates an average of 8-10 years to achieve the additional height. I note that sensitivity analysis conducted to assess the implications of increasing ages to green-up for all stands on the timber harvesting land base by 5 years showed no impact in the short term, and a less than one percent impact to mid-term timber supply. I am therefore satisfied that the additional time for some stands to achieve the 5-metre height on some portion less than 12 percent of the timber harvesting land base is unlikely to result in any significant timber supply impacts. I will therefore make no adjustments in this determination on this account.

I request that district staff continue to monitor harvesting practices in visually sensitive areas, so that any information leading to refinements in the assumptions can be incorporated into future analyses for the Revelstoke TSA. In particular, I request that staff review the VEG heights used to guide operations in modification VQC areas, so that the information can be used in future analyses.

- identified wildlife

"Identified wildlife" refers to species at risk (blue- and red-listed) and regionally significant species which are not expected to be accounted for by existing non-timber management strategies, such as for biodiversity, riparian management or other wildlife species (e.g., mountain caribou).

The provincial government announced its Identified Wildlife Management Strategy (IWMS) Volume I in February 1999. Government at that time set a one-percent limit for the province on the allowable impact on short-term harvest levels from management for identified wildlife. IWMS Version 2004 contains an updated list of identified wildlife, updated species accounts and updated procedures for implementing the IWMS.

Identified Wildlife Management Strategy Version 2004 gives the following list of identified wildlife species for the Columbia Forest District: Coeur d'Alene Salamander, Northern Leopard Frog, Lewis's Woodpecker, Short-Eared Owl, Badger, Grizzly Bear, Mountain Caribou, and Wolverine. Staff indicate that some of these species are expected to occur in the Revelstoke TSA.

No wildlife habitat areas (WHAs) or specific management strategies for identified wildlife species have yet been established in the Revelstoke TSA. As a result, no specific accounting for management for identified wildlife was made in the base case (other than the accounting for caribou habitat, which is discussed separately under that factor).

District staff note that final notices have been prepared under the authority of Section 7(2) of the Forest Planning and Practices Regulation (B.C. Reg. 14/04) which provide indicators for the amount, distribution and attributes of wildlife habitat required for survival of species at risk. The notices state for the Coeur d'Alene Salamander an area of 60 hectares, and not exceeding an impact to the mature timber harvesting land base of 36 hectares must be provided.

MWLAP staff indicate that one WHA was proposed in February 2005 for the Coeur d'Alene salamander. Staff do not yet know whether the full one percent area as committed by government provincially is expected to be required in the Revelstoke TSA to provide for species not accounted for through other measures. They note that they are not aware of any constraints currently on harvesting operations as a result of a need to provide for identified wildlife species.

I have reviewed the information regarding identified wildlife, and I consider it appropriate to take into account a reduction in the available timber supply shown in the base case of up to 1 percent, in order to ensure that the impacts of implementing the strategy are recognized. I request that MWLAP and other staff work together to establish the WHAs in the Revelstoke TSA as soon as possible. Given the intensive management in this TSA for a variety of non-timber values, such as for caribou habitat and landscape level biodiversity objectives, the expedient establishment of WHAs would greatly help with planning. I will discuss my considerations of this further under 'Reasons for decision'.

- ungulate winter range

Ungulate species present in the Revelstoke TSA include moose and deer (caribou are discussed later in this document under a separate factor). Moose and deer habitat are managed for operationally as ungulate winter range (UWR). The mapping and guidelines used in current operational planning were modelled in the base case of the analysis. Areas identified as either deer or moose habitat were grouped, and a forest cover

constraint was applied by landscape unit to reflect mature forest retention requirements. The constraint was applied to the Crown forested land base, requiring that a minimum of 40 percent of the area was to be covered in stands over 120 years of age. A total of about 30 000 hectares of productive forest was assumed to be managed for ungulates in the base case, 22 260 hectares (74 percent) of which was timber harvesting land base.

The base case assumptions reflect current operational practices. However, district staff note that some changes have recently occurred to ungulate ranges with the issuance of the final notices under the authority of section 7(2) of the *Forest Planning and Practices Regulation* (B.C. Reg. 14/04) which provide indicators for the amount, distribution and attributes of wildlife habitat required for survival of ungulate species. Notwithstanding a typographical error in the notices which incorrectly identified the landscape units to which management objectives for ungulates apply, both the total amount of area managed and the forest cover objectives themselves have been modified. The notices state that moose will require 321 hectares of habitat, of which 96 hectares will provide snow interception cover, and deer will require 17 990 hectares of habitat, of which 5 397 hectares will provide snow interception.

District staff have clarified the intent of the notices as applying to the following landscape units: R3 (Akolkolex), R7 (Jordan), R10 (LaForme), and R20 (Illecillewaet). The revised forest cover objectives state that for areas classified as moose habitat, at least 30 percent of the area is to be covered with stands at least 60 years of age in heavy snowfall areas, and 20 percent of the area to be covered in stands at least 60 years of age in moderate snowfall areas. In areas classified as deer habitat, 40 percent of the area is to be covered in stands at least 100 years of age. New linework for the revised habitat areas is not yet available, but district staff examined the existing linework and suggested modifications to approximate the expected changes.

The implications to timber supply of adjusting the assumptions to reflect the section 7 notices were assessed in sensitivity analyses and included in the published analysis report. The results indicate that the long-term timber supply could increase by about 2.5 percent compared to that projected in the base case under the revised assumptions.

When the analysis report was released, the section 7 notices were not yet finalized. District staff indicate that the assumptions modelled in the sensitivity analyses mentioned above are likely slightly more constraining to operations than the direction provided by the final section 7 notices. Although the forest cover objectives are consistent, the amount of area managed for ungulates will likely be less than what was assumed in the published sensitivity analyses.

In addition, staff indicate that the Government Actions Regulation (GAR) requirements, which are expected to be in place by December 31, 2005, will include management for moose only in moderate snowfall areas (i.e., not in most of the landscape units north of the city of Revelstoke) in order to accommodate caribou habitat needs.

Having considered the information presented about ungulates, I make the following observations. Given that the section 7 notices are now legal and provide the basis for ungulate management in the TSA, I am satisfied that it is appropriate to account for the timber supply implications of the management under the notices. I therefore conclude that the long-term timber supply projected in the base case has been underestimated by about 2.5 percent on account of changes to UWR. I will discuss this further under 'Reasons for decision'.

- caribou habitat

The Revelstoke TSA provides important habitat for mountain caribou. Mountain Caribou populations have been declining and their geographic ranges shrinking for several decades. In 1993, the B.C. Conservation Data Centre (CDC) placed Mountain Caribou on the provincial blue list of "species at risk". In 2000, caribou were moved to the red list of "threatened or endangered" species because of continuing declines in abundance and substantial threats to their survival.

In May 2002, the national Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated the Revelstoke and other Mountain Caribou sub-populations within B.C. as nationally threatened. At approximately the same time, new census information indicated that a significant decline in the local sub-populations, as well as in other populations, had occurred.

In October 2002, the provincial Mountain Caribou Technical Advisory Committee (MCTAC) released a Strategy for the Recovery of Mountain Caribou in British Columbia. The MCTAC identified the population trends of what they considered to be 13 sub-populations in B.C. Eight of these, including the two populations in the Revelstoke area, north of Highway 1, had declined by more than 20 percent in the previous seven years, and none had increased during that time frame. Current studies indicate that this trend is continuing.

The MCTAC census results for the local populations and the need for recovery action planning for local herds as outlined in the provincial recovery strategy prompted the City of Revelstoke to initiate discussions amongst interested parties regarding actions that could be taken to reverse the decline in local sub-populations. This group began its work in late 2002. Early in 2003, the provincial government began the development of a North Kootenay Recovery Action Plan under the federal *Species at Risk Act* for these sub-populations and the Central Selkirk sub-population. Both groups continue to work towards planning and implementing actions to halt population declines and restore these populations if possible.

As also mentioned elsewhere in this rationale, the MAC recommendations were formulated for the Revelstoke area between 1995 and 1999 and were intended to address the needs of mountain caribou. Major components of the MAC formed the Revelstoke and Area Land Use Planning – Final Recommendations, and the key recommendations have been incorporated into the Revelstoke Higher Level Plan order which was approved

by government in March of 2005. When the MAC Plan was developed, accounts for all resource values were addressed and the final plan attempted to find a balance between management objectives for wildlife, caribou, visuals, biodiversity and timber. At the time when the MAC made its final recommendations, caribou populations were thought to be stable. Unfortunately this is no longer the case.

The total area of caribou habitat assumed in the base case was 72 210 hectares, 35 050 hectares of which is timber harvesting land base. Caribou habitat is mapped as either 'guideline' areas (to which the forest cover requirements specified under the guideline apply), immature areas (to be recruited for future caribou habitat) or intermediate areas.

In the base case for the analysis, forest cover requirements to reflect the caribou habitat management that forms current practice in the TSA and are consistent with the MAC recommendations were modelled. The 1994 operability line, known as the 'caribou line' forms the basis for management requirements in the caribou habitat.

For the habitat located at an elevation below the caribou line, 40 percent of the forested area was required to be maintained in stands of age class 8 (140 years of age) or older, and at least one quarter of these older stands were required to be in age class 9 (over 250 years of age). In the habitat above the caribou line, 70 percent of the forested area was required to be in stands of at least age class 8. These objectives had to be met by landscape unit and by biogeoclimatic zone within each landscape unit on slopes less than 80 percent. (These areas are known as the 'guideline areas').

Some areas of caribou habitat are mapped as immature patches. The intent of the MAC is that these areas are not to be included for determining targets for the first rotation. In the modelling, no harvesting was allowed in the caribou immature areas for the first 80 years of the analysis horizon. After this time frame, the areas were grouped with others providing the same type of habitat, and the forest cover requirements associated with the type of habitat were applied.

In addition, some caribou habitat was delineated as 'intermediate'. In these areas, the seral objectives for old and mature forests as described for the intermediate biodiversity emphasis option were required to be met. Intermediate caribou habitat has been identified in the ESSFvc, ICHwk1 and ICHvk1 biogeoclimatic variants.

District staff state that what was modelled in the base case of the analysis is indeed consistent with current operational management for caribou in the Revelstoke TSA, which has been focused on maintenance of caribou habitat. However, they note that recovery has a different focus than maintenance of habitat. Recovery is responding to current national and international expectations, whereas maintenance has been the emphasis of Land Use Plans and Identified Wildlife Strategies. It is therefore uncertain whether practices will remain as they are currently, or whether they will become more restrictive in an attempt to recover caribou populations. The North Kootenay Mountain Caribou Recovery Action Plan is being drafted to address Species at Risk (SARA)

legislation, and a precautionary approach is expected to be followed. In October of 2004, the Province committed $800,000 and appointed a species at risk co-ordinator to accelerate the progress on the recovery of Mountain Caribou and other species at risk. The co-ordinator is expected to have recommendations to government on caribou recovery by the fall of 2005. I note that the Forest Practices Board has also indicated government should be taking greater steps to protect caribou.

District staff expect that changes to address caribou recovery could be made which would affect both the size and location of caribou habitat as well as the forest cover requirements. One possible recommendation that staff note is the use of a mature plus old retention requirement of 60 percent rather than 40 percent in the habitat below the caribou line.

Several different possible scenarios were modelled in sensitivity analyses to investigate the timber supply impacts of greater old and mature forest retention requirements, and/or more expansive habitat. In all cases, timber supply was affected. Expanding the area managed for caribou habitat by adding 3400 hectares of immature areas, 5430 hectares of intermediate areas resulted in a 1.8 percent decrease in long-term timber supply compared to the base case harvest forecast. However, adding to this a requirement to manage as caribou habitat all of the operable area in three landscape units – R6, R14 – and all of the operable ESSF area in landscape unit R20, for a total additional area managed of 12 100 hectares, resulted in a 4.8, 6.7 and 2.9 percent decreases in short-, mid-, and long-term timber supply respectively.

An additional sensitivity analysis showed that increasing the forest retention requirements to 60 percent of the area to be covered in stands of mature forest resulted in an immediate 12 percent reduction to the initial harvest level. The short-, mid- and long-term timber supplies were reduced by about 16, 13 and 14 percent respectively on this account.

Input received from Parks Canada staff expressed the opinion that current management practices are insufficient to support caribou recovery, noting the widespread forest fragmentation and loss of habitat from roads, clearcuts and the cumulative impacts of human activities such as motorized recreation. They expressed the opinion that caribou are on the verge of extirpation, and that the Revelstoke herd may be one of a few populations for which recovery is feasible with sufficient effort by all. Both Parks Canada and Bell Pole in its input expressed the need for spatial deployment of caribou habitat areas.

Downie Sawmills has recently completed a project of spatially mapping caribou habitat for the landscape units associated with its operations. The mapping identifies stands with appropriate caribou habitat attributes. I commend that licensee for the extensive work it has completed to better identify caribou habitat areas. I encourage BCFS staff to work with the licensee to determine if there are ways that this work could better inform future timber supply analyses for the TSA.

Management for caribou habitat is an important land resource value in the Revelstoke TSA. I have considered the information presented to me regarding current management considerations for caribou and the reflection of this in the analysis, I am satisfied that the work done was appropriate given the importance of the species and its management.

I also am mindful of the possibility that management requirements might change in the short term. I note that should management requirements change, with corresponding implications for timber supply, between now and the next scheduled determination for the Revelstoke TSA, I am prepared to revisit this determination sooner than the five years. At that time, the extensive work completed for this determination will help me to assess the implications of changing the management requirements for caribou. I will discuss my considerations of this further under 'Reasons for Decision'.

- riparian habitat

Riparian habitats occur along streams and around lakes and wetlands. The Forest Practices Code requires the establishment of riparian reserve zones that exclude timber harvesting, and riparian management zones that restrict timber harvesting in order to protect riparian and aquatic habitats. To estimate the area needed in riparian reserves and a surrogate area for riparian management zones, a spatial buffering exercise around streams was completed.

District staff prepared riparian data that followed the *Riparian Management Area Guidebook* classification for the 2004 timber supply analysis by using the watershed atlas data in conjunction with TRIM data. If the TRIM data indicated drainages that were not on the watershed atlas, slope gradient was used to determine the presence of fish. The total riparian area reserve area was determined by multiplying the management zone retention requirement (as outlined in the guidebook) by the management zone width and adding it to the reserve zone width. Staff note that W5, S4, or S6 features were not classified due to the limited scope of project. Also, they were unable to stratify between W1 and W3, and between L1 and L3, and instead applied a weighted average.

Riparian buffer areas totalling 2758 hectares were delineated in the inventory file using the data. These areas were used in the analysis to exclude a total of 1317 hectares during the derivation of the timber harvesting land base.

At the time of the TSR 2 determination in 1999, district staff identified a need to account additionally for reserves along S1 rivers, smaller seasonal streams and wetlands not well delineated in the watershed atlas and therefore not reflected in the base case. The Chief Forester took these into account in his determination, and further indicated that *'the accounting of riparian habitat should be improved'*.

District staff advise that the riparian inventory has been improved since that time. However they indicate that there is still some uncertainty regarding the representation of wetlands, small lakes designated as L1 and some of the smaller streams, which could

result in a small additional reduction in the assumed timber harvesting land base. They also note that review of operational practices suggests that more than the assumed percentage of the management zones is actually being harvested on S1 to S3 streams. Staff suggest that the percentage retained is likely closer to 30 percent than 50 percent, resulting in smaller total reserves than assumed.

In considering the information and discussing it with district staff, I am satisfied that the analysis assumptions, are consistent with the guidebook and reasonably account for management to protect riparian values. I request that district staff continue to review and improve existing data sources so as to ensure that management practices for riparian habitat are appropriately reflected in future analyses.

- community and domestic watersheds

Community and domestic watersheds cover 25 269 hectares of the Revelstoke TSA, of which 12 400 hectares are productive forest. The associated timber harvesting land base is 5340 hectares. Current management includes restricted harvesting in community watersheds to meet hydrological considerations, and no harvesting at the intake points in domestic watersheds. The Minister's Advisory Committee recommended that management in community watersheds be consistent with the directions in the *Community Watershed Guidebook.*

Management was reflected in the analysis by the application of a green-up constraint to reflect equivalent clearcut area (ECA) considerations, whereby no less than 25 percent of the productive forest area in watersheds could be covered in stands less than 6 metres in height. The constraint was applied separately to domestic and community watershed areas by landscape unit.

Normally, interpretation of the guidebook requirements for watersheds is to apply the forest cover constraint to the entire Crown land area in the watershed, rather than the productive forest area. BCFS staff indicate that although what was modelled in the analysis may have been more restrictive than what is required under the Forest Practices Code requirements, they are satisfied that it is reasonably reflective of current practices. District staff also note that very little harvesting has occurred in community or domestic watershed areas.

In the base case, watersheds were assumed to cover 6.8 percent of the timber harvesting land base in the Revelstoke TSA. Additional sensitivity analysis indicates that timber supply in the TSA is not sensitive to changing the application of the forest cover constraint to the entire Crown land area in watersheds.

Having considered the information presented to me, I am satisfied that current management practices, intended to protect water quality in domestic and community watersheds, were reasonably well reflected in the base case of the analysis, and I make no adjustments on this account.

- biodiversity

Biological diversity, or biodiversity, is defined as the full range of living organisms, in all their forms and levels of organization, and includes the diversity of genes, species and ecosystems, and the evolutionary and functional processes that link them. Under the Forest Practices Code, biodiversity in a given management unit is assessed and managed at the stand and landscape levels.

1. stand-level biodiversity

Stand-level biodiversity is managed in part by retaining reserves of mature timber or wildlife tree patches (WTP) within cutblocks to provide structural diversity and wildlife habitat.

Retention of coarse woody debris was not explicitly addressed in the analysis. Staff note that the age and nature of the stands in the Revelstoke TSA suggest that coarse woody debris objectives are achieved indirectly through the attainment of normal utilization levels in harvesting.

Wildlife tree patches (WTPs) are retained operationally on cut blocks to provide for the maintenance of stand structure over time. WTPs greater than two hectares in size can also contribute to old forest, as well as mature forest for landscape-level biodiversity objectives.

To formulate the assumptions around WTP retention for the 2004 base case, staff used retention values from *Table A 3.1* of *the Landscape Unit Planning Guide*. Only those areas harvested since 1996 were assumed to have included wildlife tree retention. Staff calculated WTP requirements for each biogeoclimatic subzone and variant. It was assumed that 50 percent of the WTP requirements would be available from the non-timber harvesting land base. In the analysis, the resulting percentages were applied to each biogeoclimatic subzone and variant by landscape unit as a land base exclusion. A total of 3154 hectares were excluded in the derivation of the timber harvesting land base to account for wildlife tree patch retention.

Staff have reviewed data from forest development plans (FDPs) and indicate that the data is consistent with the assumptions applied in the base case. However, staff have not collected data in on the ground surveys to measure the amount of area actually being retained in wildlife tree patches. They suggest that more area may be retained in WTPs than reflected in the percentages applied in the analysis.

In its public input, Bell Pole provided an alternative methodology for modelling stand-level biodiversity requirements, given the typical structure and harvest ages of stands in the Revelstoke TSA. The licensee stated that explicit land base exclusions should only be applied in stands where adequate stand structure cannot be achieved in the natural course of events. The licensee cited the results of a paper entitled *"Habitat Supply Modelling for the Arrow TSA"* in which maximum habitat suitability for pileated

woodpecker was found to be achieved at 140 years, and noted that the biogeoclimatic subzones are similar to those in the Revelstoke TSA. They stated that stands in most management zones in the TSA are harvested at ages over 150 years; therefore, at least 6.7 percent (which was the highest WTP retention requirement assumed in the analysis) of the stands in the timber harvesting land base would be between 140 and 150 years of age at any point in time. They concluded that in most areas, stand level requirements should be met assuming adequate structural considerations, and propose no explicit accounting for such stands.

The licensee further expressed the opinion that a volume reduction applied over time as stands are harvested would provide a better reflection of the timber supply impacts of wildlife tree patch retention than the land base reduction applied at the beginning of the analysis horizon.

I have considered the information regarding the modelling of stand level biodiversity, and the input of Bell Pole. While the methodology is of interest, I note that it is not consistent with current provincial policy in this regard. The latter is based upon fairly extensive and sound research, and I would suggest more work need be done before assumptions should be changed in such a significant manner. I do acknowledge the thoughtful comments of Bell Pole, and note that both approaches – volume or area reductions – are used routinely in timber supply analysis to reflect actual retention occurring operationally. I note that the amount of area excluded in the base case ranged from 1.6 to 6.7 percent of the variant areas, and totalled only about 3100 hectares, which to my mind is not an excessively large reduction when considered in context of reductions applied on this account in other management units, and when considered against the perception of district staff that even more area may be being retained than was assumed. Overall, I am satisfied that the assumptions, as based on the best available information, provide a reasonable accounting for wildlife tree retention that is also consistent with provincial policy regarding the amount of area to be retained.

I would request, however, that district staff work with licensee staff, and the staff of other ministries as appropriate, to refine estimates of the amount of area actually being left in WTPs prior to the next determination. Refinement of the estimates should provide more precise information for the next determination, and also may give guidance on whether retention would be best reflected as an area or volume reduction for this particular TSA.

2. landscape-level biodiversity

Achieving landscape-level biodiversity objectives involves maintaining forests with a variety of patch sizes, seral stages, and forest stand attributes and structures, across a variety of ecosystems and landscapes. Managing for biodiversity is based in part on the principle that maintaining these conditions—together with connectivity of ecosystems and the maintenance of forested areas of sufficient size to maintain forest interior habitat conditions—will provide for the habitat needs of most forest and range organisms.

A major consideration in managing for biodiversity at the landscape level is leaving sufficient and reasonably located patches of old-growth forests for species dependent on, or strongly associated with, old-growth forests.

Although some general forest management practices can broadly accommodate the needs of most ecosystems, more often a variety of practices is needed to represent the different natural disturbance patterns under which ecosystems have evolved. Natural disturbance types (NDTs) vary from frequent wildfires in the dry interior regions to rare stand-initiating events (from wind, fire, and landslides) in the wetter coastal regions.

The delineation and formal designation of "landscape units" is a key component of a sub-regional biodiversity management strategy. *The Landscape Unit Planning Guide* outlines three biodiversity emphasis options—lower, intermediate and higher—which may be employed when establishing biodiversity management objectives (biodiversity emphasis options, or BEOs) for a landscape unit. Each option is designed to provide a different level of natural biodiversity and a different risk to the maintenance of elements of natural biodiversity when finding an appropriate balance between biodiversity and timber supply in setting objectives for a landscape unit.

In accounting for landscape-level biodiversity in the analysis, a number of modelling assumptions were made. Three of these – current practice, disturbance in the non-timber harvesting land base, and inclusion of parks – are discussed below.

basis for current management objectives

The *Landscape Unit Planning Guide* provides guidance in most areas of the province on landscape level biodiversity objectives. These recommendations were captured in the provincial Old Growth Order. However, for the Revelstoke TSA, the Minister's Advisory Committee (MAC) recommendations included specific guidance on the achievement of landscape level biodiversity objectives which differ somewhat from the guidance provided in the *Landscape Unit Planning Guide*. As with other resource values described in this document, the MAC recommendations guide current practices in the Revelstoke TSA.

For landscape level biodiversity, the MAC recommendations differ from the standard recommendations in the *Landscape Unit Planning Guide* as follows: intermediate and high biodiversity emphasis is managed by corridor rather than by landscape unit, with most landscape units being assigned multiple biodiversity emphasis; the full old-seral forest requirement for low biodiversity emphasis areas is required to be met immediately, rather than phased in over three rotations; and, the mature plus old forest requirement is managed for in all BEOs, including areas assigned a low BEO. In addition, the biodiversity requirements for each variant must be met on the forested land base both below the operability line and on the total Crown area (proportional representation).

Landscape unit boundaries have been legalized through the provincial Old Growth Order. BEOs have been assigned in the manner recommended by the MAC. The BEO

assignment is such that 79.9 percent of the Crown forested area is in low, 11.3 percent in intermediate, and 6.4 percent in high BEOs. An additional 2.4 percent is managed as intermediate BEO to accommodate caribou habitat requirements. The timber harvesting land base associated with each BEO is as follows: 67.2 percent low, 21 percent in intermediate (3 percent of this is associated with caribou habitat objectives), and 11.7 percent in high.

In the 2004 base case, requirements for landscape level biodiversity were modelled to fully reflect the MAC recommendations. Mature as well as old forest objectives were required to be met in all BEOs, and the full old forest requirement immediately in low BEO areas. Retention objectives had to be met on both the operable landbase as well as the total forested landbase.

Several sensitivity analyses were conducted to assess the implications to timber supply if various assumptions for the management of landscape level biodiversity were modified. The implications of relaxing the requirement for proportional representation, relaxing the requirement for mature plus old seral retention, or allowing the old seral requirement in low BEO areas to be phased in over three rotations were each assessed individually. Combining the three changes described above would bring management to what is described in the provincial Old Growth Order, and the timber supply implications if this order were to apply to the Revelstoke TSA were also assessed in the sensitivity analysis.

In nearly all cases, as discussed in the analysis report, the results show that timber supply could be greater than under the assumptions in the base case, primarily in the mid term, if the assumptions were modified to what is required by the Landscape Unit Planning Guide. The only assumption which did not change timber supply availability was that around the mature seral requirement. Relaxing the need for mature seral retention made no difference to timber supply. Combining the set of assumptions to reflect the old growth order resulted in a mid-term timber supply increase of 6.4 percent, and a long-term increase of 2.1 percent. However, neither the initial harvest level nor short-term timber supply were sensitive to any of the changes.

Input received from Bell Pole questioned the use of the 2001/2002 operability line to model proportional representation, and stated that the operability line in place at the time the MAC recommendations were developed would have been more appropriate. Bell Pole expressed the opinion that timber supply could have been greater in the base case if the 1994 operability line had been used to model proportional representation.

District staff note that the recommendations carried into the approved Revelstoke Higher Level Plan order are based on the current operability line. No sensitivity analysis was done based on the 1994 operability line since the operability information has been updated and the inventory file rolled over to VRI standards, and the file no longer contains the 1994 operability information. The current operability line is considered to be the best available information regarding operability, and it would have been cumbersome from a data and file size perspective to maintain the older data in the inventory file. In any event, the operable land base defined under the 2001/2002 line is very similar in size

to that defined in 1994 (about 10,000 hectares larger). Overall, staff are satisfied that the intent of the MAC recommendations (to ensure that both timber harvesting land base and non-timber harvesting land base are assumed to contribute to biodiversity objectives) has been met with the use of the 2001/2002 information.

I have considered the information presented regarding the achievement of landscape level biodiversity objectives as modelled in the 2004 base case. The old growth order does provide a legal framework province-wide for a set of assumptions intended to provide for landscape level biodiversity needs. However, I note that the MAC recommendations form current practice in the TSA and have done so for a number of years, and are reflected both in the Revelstoke and Area Land Use Planning Final Recommendations and the Revelstoke Higher Level Plan Order. In any event, practices under the higher level plan order are consistent with the direction in the old growth order, but include additional requirements which are more constraining to timber supply than those under the old growth order alone. Overall, I am satisfied that the base case appropriately represented the management objectives for landscape level biodiversity under the higher level plan.

ageing of stands in areas outside the timber harvesting land base

Forests outside the timber harvesting land base contribute to the achievement of landscape level biodiversity objectives. While harvesting does not occur in these forests, natural agents such as fire, insects or wind create disturbances and affect the age class distribution of stands. An important aspect of timber supply modelling is to reflect operational conditions in these forests, so that the assumed contribution to old or other seral objectives is consistent with what would be available operationally.

Several different methodologies have been used in recent timber supply analyses to reflect natural disturbance regimes. Natural disturbances in the non-timber harvesting land base were not factored into the previous timber supply analysis, and in the 1999 TSR 2 determination the Chief Forester stated that *'the ageing of stands in inoperable areas is a provincial issue that requires an assessment of how to best model disturbance patterns and succession in areas outside the timber harvesting land base'*.

In the Revelstoke TSA, there are about 140,000 hectares of forests outside the timber harvesting land base. These forests fall within either Natural Disturbance Type (NDT) 1 or 2. The forests within the Engelmann Spruce Subalpine Fir (ESSF) biogeoclimatic zone are within NDT 1, whereas the forests within the Interior Cedar Hemlock (ICH) biogeoclimatic zone could be within either NDTs.

For the Revelstoke analysis, the *Biodiversity Guidebook* was reviewed to develop an estimate of appropriate disturbance regimes. Using information from the guidebook, the maximum percentage of the area that was expected to be covered in forests over 250 years of age according to the natural disturbance type was determined for each of these biogeoclimatic and NDT combinations. The results suggested that for the ESSF, a maximum of 49 percent of the area should be covered with stands over 250 years of age

at any one time; for the ICH NDT 1, 37 percent of the area, and for the ICH NDT 2, 29 percent of the area. To achieve these targets for percentage of the area in old stands, it was determined that about 300 hectares should be disturbed per year in the non-timber harvesting land base.

However district staff expressed concern about the large fires in recent years, and reviewed fire history. Based on seven years of fire history from the Protection Branch it was estimated that an average of 598 hectares of timber in the inoperable land base burned per year. This value was subsequently put into the base case.

The natural disturbances in the non-timber harvesting land base were modelled by allowing the model to 'harvest' stands (with no volume contribution) each year in the non-timber harvesting land base, for a total of 600 hectares. Once harvested, the stands reverted to an age of 0 years.

It was assumed that natural disturbances are random occurrences that could affect any age of stand. Minimum harvestable ages were set relatively low to allow the model to emulate this assumptions. Furthermore, it was necessary to reduce the minimum harvestable age to a lower age in order to ensure that the level of disturbance occurred annually as designed. Otherwise, staff noted that the model was inclined to 'hold onto areas' to meet other old growth constraints such as for caribou habitat. Given that the rationale for disturbing the non-timber harvesting land base in the modelling was to reflect the fact that there are indeed natural disturbances in this portion of the land base which affect the amount of old growth forest available to meet old seral objectives, it was important to ensure the disturbance occurred as intended. In the base case, a minimum harvestable age of 50 years was assumed.

Sensitivity analysis conducted as part of the published analysis report indicated that the assumptions around natural disturbance in the non-timber harvesting land base impact availability of timber supply. Assuming no level of natural disturbance in the non-timber harvesting land base led to achieving an additional decade at the initial harvest level before beginning to decline to a higher mid term level than in the base case. Overall, mid-term timber supply was 24 percent greater and long-term timber supply was 11.4 percent greater than in the base case. Using the suggested disturbance regime from the Guidebook resulted in a 17.8 and 10.5 percent increase in mid- and long-term timber supply respectively, as compared to the base case.

In preparation for the determination meeting, staff reviewed the assumptions regarding natural disturbances in the non-timber harvesting land base. District staff note that their earlier estimate included losses from 2003, which when averaged over a 7 year time horizon increased the estimate by 400 hectares per year. Staff now believe after having reviewed fire history over a much longer timeframe (44 years) that an appropriate estimate of fire losses is closer to between 300 and 350 hectares per year. This value is very close to the disturbance values suggested by the biodiversity guidebook methodology.

Staff also note that disturbances in the non-timber harvesting land base are not likely to impact green-up constraints in the timber harvesting land base. It was originally intended in the base case that stands disturbed on the non-timber harvesting land base would 'regenerate' to an age of 30 years to reflect this. The implication of the disturbed stands regenerating following 'harvest' to an age of 30 years was assessed in sensitivity analysis, and it was found to increase both mid- and long-term timber supply.

Further sensitivity analysis in which a regeneration age of 30 years was assumed in combination with half the level of natural disturbance (Guidebook methodology levels) in applied the base case led to an additional improvement in long-term timber supply.

I have reviewed the information regarding natural disturbance in the non-timber harvesting land base. Mid- to long-term timber supplies in the Revelstoke TSA are very sensitive to the assumptions regarding natural levels of disturbance in the non-timber harvesting land base. It is important to ensure that a level of disturbance is assumed which is reflective of what would be expected to occur naturally. No specific information has been collected on the natural disturbance regimes in the Revelstoke TSA. I am aware that some work is currently underway provincially to attempt to better refine our understanding of disturbance regimes. I encourage the continuation of research which will enable us to better understand regimes in various parts of the province and what the possible implications to timber supply may be.

In the absence of any localized information, I accept that the methodology applied in which the expected percentages of older forest suggested in the Biodiversity Guidebook tables were applied as targets, provides a reasonable assessment of disturbance regimes. I therefore recognize that timber supply in the base case has been underestimated due to the assumptions regarding natural disturbance, and I will discuss this further in my 'Reasons for Decision'.

contribution from forested areas in adjacent parks

The Revelstoke TSA includes areas of adjacent parks. These areas were excluded in the process of defining the productive forested land base. Typically in timber supply analysis, the forested portion of parks is assumed to contribute to landscape level biodiversity or other old seral requirements. However, in the 2004 base case, these areas – approximately 10 800 hectares – were inadvertently excluded.

In preparation for the determination meeting, the parks areas were included in the forested land base and the timber supply implications were assessed in a sensitivity analysis. The results showed that timber supply was unaffected by the contribution of the additional area. Staff reviewed the results, and indicate that several factors contribute to this result:

1) Virtually all of the parks area (about 98 percent) was assigned a low BEO, and therefore the area only contributed to the achievement of objectives for low BEO areas;

2) The parks area was almost entirely (98.8 percent) added to two landscape units: LaForme, and Illecillewaet (LUs 10 and 20). These two LUs already contained a high proportion of non-timber harvesting land base in comparison to the timber harvesting land base (i.e., between 25 to 30 percent of those landscape units is timber harvesting land base). Therefore, there was already an abundance of forest outside the timber harvesting land base to meet the objectives.

3) Proportional representation requires that the objectives be met both on the total landbase and the operable landbase. None of the parks area is classified as operable land base, so it was only available to contribute to the total landbase objective, within those two landscape units only. Some of the area being naturally disturbed would have been operable (but outside the THLB).

I have reviewed the information regarding the contribution of provincial parks assumed in the analysis. I am satisfied that it is appropriate to consider these areas in the land base contributing to landscape level biodiversity objectives. I am aware, however, of the results of the sensitivity analysis that indicates the base case timber supply is unaffected on this account. I will discuss my considerations further under my 'Reasons for Decision'.

(vi) any other information that, in the chief forester's opinion, relates to the capability of the area to produce timber;

First Nations

- Overview

First Nations reserves or communities are not located within the boundaries of the Revelstoke TSA.

The Revelstoke TSA falls within the expressed areas of interest of three First Nations represented by eight Bands and three Tribal Councils. The following list describes the organization of Bands and Tribal Councils of those First Nations that have expressed their aboriginal interest in the Revelstoke TSA:

Kutunaxa/Kinbasket Tribal Council (KKTC)

- Akisqnuk First Nation (formerly Columbia Lake Band)

Okanagan Nation Alliance (ONA)

- Okanagan Indian Band

Shuswap Nation Tribal Council (SNTC)

- Adams Lake Indian Band
- Neskonlith Indian Band
- Simpcw First Nation (formerly the North Thompson Band)
- Spallumcheen Indian Band

- Little Shuswap Indian Band
- Shuswap Indian Band

- Kutunaxa/Kinbasket Tribal Council (KKTC)

The Ktunaxa Nation has stated their traditional territory extends to lands adjacent to the Kootenay and Columbia Rivers and the Arrow Lakes of British Columbia. The Traditional Territory of the Ktunaxa Nation covers approximately 70 000 square kilometers within the Kootenay region of south-eastern British Columbia and historically included parts of Alberta, Montana, Washington and Idaho. There is overlap in the northern portion of the territory with the Secwepemc Nation through the Kinbasket family, formerly referred to as the Shuswap Indian Band. This overlap and shared territory is acknowledged in the name of the Kutunaxa/Kinbasket Tribal Council.

The Kutunaxa/Kinbasket Tribal Council is in the process of negotiating a comprehensive treaty settlement within the British Columbia Treaty Commission six stage treaty process. The Kutunaxa/Kinbasket Treaty Council entered the treaty process in December 1993, and is now in stage 4 of the process.

The KKTC was offered a Forest and Range Agreement by the BC Ministry of Forests in January 2004, and are currently engaged in negotiations.

- Akisqnuk First Nation

The communities for the Akisqnuk First Nation (formerly Columbia Lake Band) are located east of the TSA. The Akisqnuk First Nation is comprised of 249 members (Canada Census, 2001), and is located on two reserves encompassing about 3412 hectares at Windermere Lake, near the town of Windermere.

- Okanagan Nation Alliance (ONA)

The Okanagan Nation has stated that their traditional territory extends over an area approximately 69 000 square kilometres. The northern area of this territory was close to the area of Mica Creek, just north of modern day Revelstoke, BC, and the eastern boundary was Kootenay Lake. The southern boundary extended to the vicinity of Wilbur, Washington and the western border extended into the Nicola Valley.

The Okanagan Nation Alliance administration office is located in Westbank and represents seven Bands, including the Okanagan Indian Band. The ONA is not currently in the BC Treaty Commission treaty process, however, government representatives are working to build relationships with the Okanagan Nation Alliance.

- Okanagan Indian Band

The Okanagan Indian Band administration office is located at the head of Okanagan Lake in the city of Vernon. They have a total of six reserves on approximately 11 282 hectares.

There are 1651 members registered with the Okanagan Indian Band (Canada Census, *2001*).

The Okanagan Indian Band has been offered a Forest and Range Agreement (FRA) by the BC Ministry of Forests in November 2004.

- Shuswap Nation Tribal Council (SNTC)

The Secwepemc Nation is comprised of 17 bands, dispersed over approximately 18 percent of the total area of British Columbia, in the south-central interior. The Secwepemc traditional lands total approximately 105 000 square kilometres, extending from Jasper in the Northeast, down through Invermere in the southeast, into Washington and west over to Pavilion and finally northwest to Soda Creek.

The Shuswap Nation Tribal Council represents eight First Nations, including four who have expressed interest in areas overlapping with the Revelstoke TSA; Neskonlith Indian Band, Adams Lake Indian Band, Simpcw First Nation (formerly known as the North Thompson Indian Band), and Spallumcheen Indian Band.

The Shuswap Nation Tribal Council member Bands are not involved in the B.C. Treaty Commission process, however, representatives from the British Columbia government are working to build relationships with the Shuswap Nation Tribal Council outside of the six-stage treaty process.

In November 2003, the BC Ministry of Forests signed a Wildfire Agreement with the Shuswap Nation Tribal Council (and Little Shuswap Indian Band) inviting the participating Band members to apply for a non-replaceable forest licence (NRFL) of 1.035 million cubic metres of fire-damaged timber in the Kamloops Timber Supply Area.

- Neskonlith Indian Band

The Neskonlith Indian Band's main community is on Neskonlith Indian Reserve #1, on the South Thompson River just below Little Shuswap Lake, near Chase. In total they have 562 members (Canada Census, 2001) on three reserves encompassing about 2787 hectares.

The Neskonlith Indian Band was offered a Forest and Range Agreement by the BC Ministry of Forests in September 2004.

- Adams Lake Indian Band

The Adams Lake Indian Band has 696 members (Canada Census, 2001). The main community is on Sahkaltkum Indian Reserve #4, on the Thompson River north of the town of Chase. Adams Lake has seven reserves totalling approximately 2886 hectares.

The Adams Lake Indian Band signed a 5-year Smallwood Agreement (July 2004) inviting the participating Band members to apply for a smallwood non-replaceable forest licence

of 10 000 cubic metres in the Kamloops Timber Supply Area. In January 2005 the Adams Lake Indian Band signed a FN Wildfire Agreement for 20 000 cubic metres of fire-damaged timber in the West Seymour (K30464) fire area.

The Adams Lake Indian Band was offered a Forest and Range Agreement by the BC Ministry of Forests in February 2004.

- Simpcw First Nation (formerly North Thompson Indian Band)

The 592 members (Canada Census, 2001) of the Simpcw First Nation are primarily located in the main community on Indian Reserve # 1, situated along the North Thompson River near the town of Barriere, approximately 80 kilometres north of Kamloops. The North Thompson Indian Band has five reserves on about 1 501 hectares.

The Simpcw First Nation, through the Lower North Thompson Community Forest Society, has a 3-year Interim Measures Agreement (December 2004) inviting the participating Band members to apply for a non-replaceable forest licence of 100 000 cubic metres of mountain pine beetle timber in the Kamloops Timber Supply Area.

- Spallumcheen Indian Band

The Spallumcheen Indian Band has 707 members (Canada Census, 2001) located on three reserves totalling about 3906 hectares. The Band administration office is located in the town of Enderby.

The Spallumcheen Indian Band was offered a Forest and Range Agreement by the BC Ministry of Forests in August 2004 and are currently engaged in negotiations.

The Spallumcheen Indian Band signed a FN Wildfire Agreement with the BC Ministry of Forests (November 2003) inviting Band members to apply for a non-replaceable forest licence of various cubic metres of fire-damaged timber in 11 fire areas of the Okanagan Timber Supply Area.

- Little Shuswap Indian Band

In 2003, the Little Shuswap Indian Band became re-affiliated with the Shuswap Nation Tribal Council. Little Shuswap is comprised of 292 members (Canada Census, 2001) located primarily on five reserves near Little Shuswap Lake. Most of the band members live in the main community at Squilax (Indian Reserve # 1) between Shuswap and Little Shuswap Lakes.

As mentioned above, in November 2003, the province signed a Wildfire Agreement with the Little Shuswap Indian Band (and the Shuswap Nation Tribal Council) inviting the participating Band members to apply for a non-replaceable forest licence of 1.035 million cubic metres of fire-damaged timber in the Kamloops Timber Supply Area.

In December 2004, the Little Shuswap Indian Band signed a 5-year Forest and Range Agreement (FRA) with BC Ministry of Forests. Both parties are currently in the first year of FRA consultation, which requires First Nation consultation on all administrative and operational decisions.

*- Shuswap Indian Band**

The Shuswap Indian Band Administration office is located in the town of Invermere. The Shuswap Band is comprised of 221 members (Canada Census, 2001) on two reserves comprised of 1246 hectares, which are located on the east bank of the Columbia River, north of Invermere. (*Currently, it is unclear which Tribal Council, KKTC or SNTC, the Shuswap Indian Band is affiliated to).

The Shuswap Indian Band was offered a Forest and Range Agreement in January 2004 and are currently engaged in negotiations.

- Consultation Process

BCFS staff solicited input on the timber supply review process from all the First Nations listed above through the following process:

- A cover letter with copies of the data package, TSA map and the Timber Supply Review Backgrounder document were sent to each of the First Nations groups listed above, in July 2002;
- An email was sent out to the same groups advising of the release of the *Revelstoke Timber Supply Area Analysis Report* and its availability on a Ministry of Forests web site, in September 2004;
- A cover letter and copies of the September 2004 *Revelstoke Timber Supply Area Analysis Report*, Public Discussion Paper and additional copies of the Timber Supply Review Backgrounder were sent in October 2004;

BCFS district staff also made efforts to contact the appropriate person in each First Nations group by phone. Dates of contact and the nature of phone discussions were documented by BCFS staff. A meeting was held with the Shuswap Indian Band in Invermere on February 11, 2005.

BCFS staff indicate that the comments received from First Nations can be summarized as follows:

- Some First Nations groups have indicated that the provincial government's consultation framework, land use referral and administrative system are inadequate to deal with First Nations in consultation on land and resources to meet the fiduciary obligations of B.C.;
- Some First Nations groups advise that they do not have the time, funding, or knowledge to review the documents and provide meaningful comment. They believe that government should supply resources to enable First Nations to participate in meaningful consultation.

I have considered the information presented, and I acknowledge the consultation done by district staff with the First Nations groups who have expressed interest in the area encompassed by the Revelstoke TSA. The concerns expressed by the First Nations groups are familiar to me, and have been brought to my attention in AAC determinations for other management units in the province. The input received from First Nations during the timber supply review process references important issues that are not, however, directly related to my area of authority. They include general concerns about the need for improved capacity to participate in the future planning initiatives and referral processes. While I am unable to address these concerns, I will make those concerns and interests known to other appropriate decision-makers. I also note that there is a separate consultation process in effect regarding timber allocation decisions related to the apportionment of the AAC that are not part of my decision authority under Section 8 of the *Forest Act* that only empowers me to determine the AAC.

In reviewing First Nations input, I believe my determination has reflected on the interests and concerns expressed that relate to my area of authority. I will convey First Nations interests and concerns to others in this Ministry who are in a position to consider and address those that are beyond the ambit of my jurisdiction.

I note that district staff continue to be available to meet and consult with First Nations on specific issues which can be addressed at the operational planning level.

Forest development plans and harvest sequencing

Under the Forest Practices Code, forest development plans (FDPs) have been prepared annually by the licensees in the TSA to identify areas of planned harvest. FDP information up to 2002 regarding recently harvested areas and planned (category A) cutblocks was incorporated into the base case.

District staff indicate that licensees have indeed been harvesting their apportioned volume, and meeting cut control requirements. Although no specific availability issues have affected operations to date, district staff advise that a review and reallocation of operating areas may be necessary in the future. Operating areas have not been reallocated since the establishment of the Revelstoke TSA.

Several different harvest rules were applied in the base case in order to simulate operational considerations. The first priority was placed on those stands identified through the FDP information as category A blocks, as it was anticipated that these blocks reflected the majority of stands the licensees intend to harvest in the short term. This priority was in place for the first decade of the analysis horizon only.

In addition, district staff indicate that cedar- and spruce-leading stands are currently targeted for harvest. To reflect this, a priority was placed on stands in the old growth spruce and cedar analysis units which directed the model to select these stands for harvest first for the first three decades of the analysis horizon (following the attainment of the category A priority above for the first decade).

Finally, it was assumed that stands oldest relative to their minimum harvestable age were harvested first. For unmanaged stands – those harvested exclusively for the first six decades of the analysis horizon – this corresponded to the priority harvest of stands furthest from the age at which the mean annual increment (MAI) for volume culminated, or peaked. This harvest priority remained in place for the entire analysis time horizon.

In all cases, other objectives in the analysis such as those for forest cover were not violated in order to harvest a priority stand.

Sensitivity analyses were conducted to evaluate the implications if different harvest priorities were assumed. However, district staff state that they are satisfied that the harvest priorities applied in the base case, in conjunction with the requirements for meeting other objectives such as those for forest cover, reasonably reflect current operational considerations in the selection of stands for harvest.

I therefore conclude that there are no issues related to harvest priorities or forest development plans impacting the determination of an AAC at this time, and I make no adjustments on this account. I do make one observation, however. Using a selection criteria for stands whereby they are harvested close to CMAI, before volume increments begin to decline, is a good approach to maximize potential volume productivity of sites. The relative oldest first harvest rule applied in the base case reflected this approach – and the sensitivity analyses showed that use of a different harvest rule resulted in reductions in timber supply at some point in the analysis time horizon. I encourage licensees to keep this in mind in planning their harvesting operations in the TSA.

(b) the short and long term implications to British Columbia of alternative rates of timber harvesting from the area;

Alternative harvest flows

The nature of the transition from harvesting old growth to harvesting second growth is a major consideration in determining AACs in many parts of the province. In the short term, the presence of large volumes of older forests often permits harvesting above long-term levels without jeopardizing future timber supply. In keeping with the objectives of good forest stewardship, AACs in British Columbia have been and continue to be determined to ensure that current and medium-term harvest levels will be compatible with a smooth transition toward the usually (but not always) lower long-term harvest level. Thus, timber supply should remain sufficiently stable so that there will be no inordinately adverse impacts on current or future generations. To achieve this, the AAC determined must not be so high as to cause later disruptive shortfalls in supply nor so low as to cause immediate social and economic impacts that are not required to maintain forest productivity and future harvest stability.

Several different harvest flows were assessed in the process of selecting of a base case harvest forecast in the timber supply analysis. These flows offered different rates of decline, different initial harvest levels, and potential trade-offs between short- and long-term harvest levels. One alternative projected a non-declining even flow harvest at a

level 26 percent below the base case initial harvest level for the entire analysis horizon. In another alternative, five percent declines per decade were modelled, reaching the mid-term level one decade later, and the long-term level six decades later than in the base case.

Review of alternative harvest flows can provide information about the amount of timber supply flexibility available in the short-, mid- or long-term. For example, one alternative flow showed that the initial harvest level could be up to 11 percent higher than in the base case, if it were acceptable to hold the mid-term level for an additional three decades. This flexibility informs my decision if there are factors acting to decrease the short-term timber supply shown in the base case. My considerations of the flexibility are discussed further under 'Reasons for Decision'.

With respect to the alternative flows explored in the analysis, I am satisfied from the information presented and discussion with BCFS staff that the base case harvest forecast represents an appropriate balance between short- and long-term objectives and provides a suitable reference from which to assess timber supply.

Community implications

A socio-economic analysis was conducted as part of the analysis, as documented in the September 2004 *Revelstoke Timber Supply Area Analysis Report*. The analysis indicated that forestry activity accounts for 23 percent of the employment in the TSA and 24 percent of the income. The most significant source of employment is tourism at 34 percent, but this sector contributes only 15 percent of the basic income in the TSA. Other significant employment and income sectors include transportation (rail and highway) as a result of Revelstoke's location on a national east-west transportation route. The public sector also provides a significant contribution at 21 percent of basic employment and 17 percent of basic income.

The socio-economic analysis included estimates of the economic implications of the harvest in the TSA. The AAC for the Revelstoke TSA of 230 000 cubic metres per year supports 315 person years of employment annually within the TSA, including direct and indirect or induced jobs. It also provides 9.94 million dollars in employment income within the TSA. Provincially, it supports 638 full time jobs and 18.55 million dollars in employment income, and contributes 3.23 million dollars to gross provincial revenue (based on stumpage and related payments, and employee income taxes).

Some volume is harvested from stands in the TSA but is not able to be processed by the mills within the TSA and is shipped elsewhere, most notably pulp quality wood. The volume harvested from stands within the TSA comprises only about 69 percent of the total milling capacity. Additional volume from TFLs or TSAs adjacent to the Revelstoke TSA feeds Revelstoke area mills.

I am aware of the contribution that the volume harvested from the TSA provides to both the local and provincial economy.

(d) the economic and social objectives of the government, as expressed by the Minister, for the area, for the general region and for British Columbia;

Minister's letter and memorandum

The Minister expressed the economic and social objectives of the Crown for the province in two documents to the chief forester—a letter dated July 28, 1994, (attached as Appendix 3) and a memorandum dated February 26, 1996, (attached as Appendix 4). These letters are consistent with the objectives of forest stewardship, a stable timber supply, and allowance of time for communities to adjust to harvest-level changes in a managed transition from old-growth to second-growth forests, so as to provide for community stability.

The Minister specifically stated in his letter of July 28, 1994, that "any decreases in allowable cut at this time should be no larger than are necessary to avoid compromising long-run sustainability." He placed particular emphasis on the importance of long-term community stability and the continued availability of good forest jobs. To this end he asked that the chief forester consider the potential impacts on timber supply of commercial thinning and harvesting in previously uneconomical areas. To encourage this the Minister suggested consideration of partitioned AACs.

Both of these documents apply to the Revelstoke TSA. Staff advise me that there are presently no opportunities for commercial thinning in the TSA, and the analysis assumptions appropriately made no assumptions of this practice. I have considered the direction regarding opportunities for harvest in previously uneconomic areas. I am satisfied, based on both my own observations in overview flight, as well as the information provided to me from district staff, including staff's repeated reassessments of the operability line, that the licensees in the TSA are operating at the extent of what is viable from the perspective of both physical and economic criteria. I do not believe that there are currently any further opportunities in this TSA in this regard.

The Minister's memorandum addressed the effects of visual resource management on timber supply. It asked that pre-Code constraints applied to timber supply in order to meet VQOs be re-examined when determining AACs in order to ensure they do not unreasonably restrict timber supply. I am aware that visual resources were among the resource objectives considered in balance during the development of the Minister's Advisory Committee recommendations. I am satisfied that the current practices for visual management in the TSA, as well as the assumptions in the analysis, are consistent with the direction provided in the Minister's memorandum.

Local objectives

The Minister's letter of July 28, 1994, also suggested that the chief forester should consider important social and economic objectives that may be derived from the public input in the timber supply review where these are consistent with government's broader objectives.

The timber supply review process for the Revelstoke TSA included opportunities for public review of both the data package and the timber supply analysis. The data assumptions were documented in an information report released in 2002 which invited comment from licensees, the public and First Nations. Input received was considered during the development of the assumptions and methodologies applied in the timber supply analysis. The September 2004 *Revelstoke Timber Supply Area Analysis Report* was accompanied by a public discussion paper, again soliciting input. I have reviewed and considered the input received, and where possible, I have attempted to respond briefly to this input in this rationale. I acknowledge the thoughtful and intelligent nature of the input and note that all input received is an important consideration in my determination.

The Kootenay Boundary Land Use Plan (KBLUP) Higher Level Plan (HLP) does not apply to the Revelstoke TSA. The Minister's Advisory Committee (MAC) recommendations which were developed between 1996 and 1998 guide current practices in the Revelstoke TSA, as well as the adjacent TFLs (TFLs 55 and 56).

The Revelstoke and Area Land Use Planning Final Recommendations (October 1999) developed by the Revelstoke Minister's Advisory Committee were endorsed by government in April 2001. The key recommendations from the MAC have been captured in the Revelstoke Higher Level Plan Order which was filed in March of 2005. As mentioned in my guiding principles, I do not base my determinations on land use decisions by taking into account aspects of the decision that impact timber supply before the decision has been made by government. The Revelstoke Higher Level Plan order has now been approved by Government. This higher level plan reflects key Minister's Advisory Committee's recommendations which has defined current practice in the TSA since 1998. I am satisfied that the analysis is consistent with current practice, the Revelstoke and Area Land Use Planning Final Recommendations and the Revelstoke Higher Level Plan Order.

(e) abnormal infestations in and devastations of, and major salvage programs planned for, timber on the area.

Unsalvaged losses

Timber volume losses due to insects and diseases that normally affect stands (endemic losses) are generally accounted for during inventory sampling of existing stand volumes. Additional losses such as abnormal (epidemic) infestations are not generally included in the sampling and therefore further accounting is required in estimating the timber supply.

Timber volumes from stands damaged by causes such as fire, insects and disease are often salvaged. However, some timber volume may not be recovered through salvage operations due to factors such as limited road access or low residual timber value.

In regenerated forests, a number of parasites, fungi or plants can kill trees or degrade the quality and value of logs. Losses associated with second-growth stands are addressed by application of operational adjustment factors (OAFs) as noted under *volume estimates for regenerated stands*.

The methodology used to determine values to account for unsalvaged volume losses in existing stands for the 2004 analysis was the same as that employed in the previous analysis. Information was collected from district staff, licensee annual reports, the fire reporting system, MLSIS/ISIS databases, and Forest Insect Disease Survey (FIDS) reports to determine actual quantified losses. An annual loss estimate of 38.1 hectares was correlated to an annual volume loss of 9219 cubic metres, and this volume was deducted from all harvest forecasts in the analysis.

Most of the estimated losses are attributed to fire, with the remaining volume loss resulting from Douglas-fir bark beetle, hemlock looper and blowdown.

Subsequent to the completion of the analysis, district staff reviewed the unsalvaged loss estimates in context of the fire seasons in 2002 and 2003. Incorporating the heavier fire seasons into only a nine-year data average would suggest losses about three time what was estimated in the base case. However, staff indicate that this would overestimate annual losses because the data was measured over a short time horizon. Staff instead retrieved fire records dating back 44 years, and prepared an average annual fire loss over this time horizon to better account for cyclical variations. Based on this more inclusive data, staff indicate that unsalvaged losses should be about 2500 metres greater per year than assumed in the base case.

I have considered the information regarding unsalvaged loss estimates for the Revelstoke TSA, and I note that there is always some uncertainty associated with extrapolating a value such as this across a long time frame – certain factors, such as climate changes or improved access through out the TSA – could act to either increase or decrease the losses experienced in the future. I have reviewed the methodology used by district staff to prepare fire loss estimates, and I am satisfied that it provides a reasonable estimate. Therefore, in this determination I will account for an additional 2500 cubic metres of volume lost and not salvaged, and I will discuss this further in 'Reasons for Decision'.

Reasons for Decision

In reaching my AAC determination for the Revelstoke TSA, I have considered all of the factors presented above, and I have reasoned as follows.

Under the assumptions applied in the 2004 base case, as discussed throughout this document, it was possible to attain an initial harvest level of 230 000 cubic metres per year. This harvest level could be maintained for 20 years before beginning a set of three 10 percent per decade declines, and a further decline of two percent, to the mid-term level of 165 000 cubic metres per year. The long-term harvest level, reached in decade 14, was 170 500 cubic metres per year.

In determining an AAC for the Revelstoke TSA, I have identified a number of factors which, if considered separately, indicate that timber supply may be either greater or less than what was projected in the base case. Some of these factors can be readily quantified

and their impact on the harvest level assessed with reliability. Others may influence timber supply by introducing an element of risk or uncertainty to the decision, but cannot be reliably quantified at this time.

I have identified the following factors in my considerations as indicating that the timber supply projected in the base case may have been overestimated:

- *Mount Mackenzie* - the approval of a master plan for the development of the Mount Mackenzie ski resort within the boundaries of the Revelstoke TSA results in a 2.5 percent land base withdrawal and a corresponding 2.6 percent reduction in the initial harvest projected in the base case. Timber supply across all time horizons is reduced by 2.5 percent;

- *Unmerchantable forest types* – I accounted for the exclusion of all pure balsam and balsam-hemlock stands (ITGs 18 and 19), as well as half of the pure hemlock stands (ITG 12). Considered in conjunction with some 400 hectares of hemlock-deciduous stands that ought to have been retained in the timber harvesting land base, this results in an additional reduction in the size of the timber harvesting land base of 1028 hectares;

- *Not-satisfactorily-restocked areas* – as a result of additional area occupied by stands with lower stocking than was assumed in the base case for the first rotation, short-term timber supply is slightly less (by well less than one percent) than projected;

- *Identified wildlife* – given the expected occurrence of identified wildlife species in the TSA, I find it appropriate to account for an up to one percent reduction in the size of the timber harvesting land base and a corresponding one percent reduction in the harvest level across all time horizons;

- *Non-recoverable losses* – based on an additional review of wildfire records, I determined that it is appropriate to account for an additional 2500 cubic metres of volume lost and not salvaged annually;

I have also identified the following factors that indicate that timber supply projected in the base case may have been underestimated:

- *Site productivity estimates* – it is likely that site productivity is underestimated, by an uncertain amount, and that timber supply may be greater in the mid term and the long term on this account;
- *Select seed* – I considered that future use of select seed could increase long-term timber supply by up to 3.5 percent;
- *Ungulate winter range* – an increase in long-term timber supply of about 2.5 percent compared to that in the base case is indicated under the section 7 notices guiding current management for ungulates in the TSA;

- *Natural disturbances in the non-timber harvesting land base* – reducing the level of natural disturbance in the non-timber harvesting land base to a level based on Biodiversity Guidebook suggested values for old forest, indicate mid- and long-term timber supply could be 17.6 and 13.7 percent greater than assumed in the base case.

In addition, although not expected to influence timber supply, I note that the forested area of adjacent parks ought to be included as contributing towards landscape level biodiversity objectives.

Each of the above factors affects timber supply on its own account. Understanding the interactions between the factors and the corresponding influence on timber supply can be complex. In support of the determination meeting, in order to assist me with evaluating the interactions of the influences described above and others possibly influencing timber supply, a set of supplemental harvest forecasts were performed. In these supplemental forecasts, a number of key assumptions were adjusted from those in the base case, to further investigate specific uncertainties identified after the analysis report was published.

In making my determination, I am mindful of the results of one supplemental forecast in particular. The following assumptions were made in this forecast:

1. The forested area of adjacent parks (10 805 hectares) was included in the non-timber harvesting land base to contribute to landscape-level biodiversity objectives;

2. The Mount Mackenzie ski resort area was excluded;

3. The area of those stands over 140 years of age and within ITGs 12, 18 and 19 were excluded from the timber harvesting land base;

4. ITG 17 stands between the ages of 25 and 140 years were included in the timber harvesting land base (400 hectares);

5. The natural disturbance regime within the non-timber harvesting land base area was modified as follows: the rate of disturbance was reduced to the levels suggested by the Biodiversity Guidebook methodology, and the age at which the disturbed stands were assumed to regenerate was changed from 0 to 30 years to avoid influencing green-up requirements;

6. Unsalvaged losses were increased from 9219 cubic metres per year to 11 700 cubic metres per year to account for higher losses from fires.

7. Ungulate Winter Range requirements for deer and moose were modelled consistently with the Section 7 notices.

In this supplemental forecast, the short-term harvest level of 230 000 cubic metres per year could be maintained for an additional decade compared to the base case before declining. A mid-term level of 181 000 cubic metres (10 percent higher than in the base case) and a long-term level of 190 000 cubic metres (11.4 percent higher than in the base case) were possible.

The results of this forecast indicate to me that timber supply in the Revelstoke TSA is relatively stable, even with the specific pressures that are acting to reduce supplies in the shorter term. These pressures include the land base removal associated with the Mount Mackenzie ski resort, the additional uncertainty around the merchantability of certain hemlock and balsam stand types, any land base exclusions associated with the establishment of wildlife management areas, and the additional volumes lost and unsalvaged from fires.

Moreover, the factors acting to increase timber supply in the mid to long term that were not modelled in the combination run – the future use of select seed, and potential underestimates in site productivity – are likely to further enhance stability of timber supply in this TSA. In addition, I am satisfied that the stability illustrated in the combination run, in particular over the five decade time horizon indicated, mitigates the implications of additional factors acting to reduce timber supply: a one percent reduction in the available timber harvesting land base as a result of the establishment of WHAs in the TSA, and the slightly reduced volume on some NSR areas than assumed in the base case.

There are two other factors that create particular uncertainty around timber supply in the short term. The inventory audit identified that volume estimates for existing stands may be overestimated. However, as noted earlier in this document, based on the available information I find it difficult to determine if there is indeed an overestimation, and if so, to what extent timber supply might be affected. I am aware that licensees are able to satisfy their quota requirements, and that no specific concerns have been identified which would indicate volumes are greatly different than estimated. In consideration of the information, I conclude that the existing stand volume estimates are within the expected range. However, I urge (as noted under Implementation) the completion of a VRI phase II inventory for the Revelstoke TSA so that any sources of uncertainty can be quantified or eliminated.

I am also aware that the objectives for managing caribou habitat in the TSA may change in the future as the various experts charged with determining necessary steps for recovery of caribou populations further refine their recommendations. Having fully examined the analyses conducted to investigate variations in caribou management regimes, I am mindful that evolving management recommendations for caribou could have associated impacts to the timber supply in the TSA. However, I am aware of the results of another supplemental forecast in which the same assumptions as the one described above were applied, but in addition, full guideline objectives were applied to all mapped caribou habitat areas. The results of this forecast, in which the only impact compared to the first supplemental forecast described was a five-decade delay in reaching the long term harvest level, indicates to me that there is some flexibility within timber supply to accommodate additional constraints for caribou habitat.

I note that if government makes a decision on management requirements for caribou habitat in the TSA which has implications for timber supply, I am prepared to revisit this determination sooner than in the five years required by legislation to adjust the AAC as necessary.

I also note that the construction of the Mount Mackenzie ski resort is expected to result in the harvest of stands which will contribute an estimated 200 000 cubic metres to the harvest of the Revelstoke TSA over the expected 20 year implementation of the project.

Having considered and reviewed all information, it is my conclusion that it is appropriate to determine an AAC for the Revelstoke TSA of 230 000 cubic metres per year, unchanged from the current AAC.

Determination

Having considered and reviewed all the factors as documented above, and taking into account the risks and uncertainties of the information provided, it is my determination that a timber harvest level that accommodates objectives for all forest resources during the next five years, that reflects current management practices as well as the socio-economic objectives of the Crown, can be best achieved in the TSA by establishing an AAC of 230 000 cubic metres.

This determination is effective September 1, 2005, and will remain in effect until a new AAC is determined, which must take place within five years of the effective date of this determination.

Implementation

In the period following this decision and leading to the subsequent determination, I encourage BCFS staff to undertake the tasks and studies noted below. I recognize that the ability of staff to undertake these projects is dependent on available staff time and, in some cases, funding. However, in my estimation these projects are important to help reduce the risk and uncertainty associated with key factors that affect the timber supply in the TSA.

I request the following:

- *Operability* – that district staff continue to monitor harvesting performance against the defined operable land base to ensure that assumptions for the purposes of the timber supply review process remain appropriate;

- *Environmentally sensitive areas* – that prior to the next determination, district staff review and rationalize the available data for soils, to ensure that analysis assumptions continue to reflect our best assessment of areas restricted from timber harvest for soils considerations;

- *Unmerchantable forest types* – that BCFS and licensee staff continue to monitor harvesting performance in marginal stands (ITGs 18, 19 and 12; and hemlock-leading stands in general) over the next five-year period to ensure that the assumptions around merchantability are a reflection of true operational conditions in the TSA. In addition, I request monitoring of the level to which unmerchantable forest types are selected to contribute to other forest cover objectives, such as for caribou habitat;

- *Volume estimates for existing stands* – that staff from the BCFS collaborate with licensee staff to undertake a phase II vegetation inventory prior to the next determination for the Revelstoke TSA;

- *Site productivity estimates* – that district and licensee staff work to gather local data to better quantify the site productivity in old growth stands;

- *Operational adjustment factors* – that district and licensee staff investigate if the available free growing data may be used to refine OAFs. I also request that the OAF 2 values continue to be refined so that any changes in the assumptions can be incorporated into future analyses;

- *Not-satisfactorily-restocked areas* – that BCFS and licensee staff review NSR records as time and resources permit, enlisting the assistance of former MSRM staff as required, so that better information is available for future determinations for the Revelstoke TSA;

- *Visually sensitive areas* – that district staff continue to monitor harvesting practices in visually sensitive areas, including an assessment of the VEG heights applicable to stands in modification VQC areas, so that any information leading to refinements in the assumptions can be incorporated into future analyses for the Revelstoke TSA;

- *Identified wildlife* – that MOE and other agencies work together to establish the WHAs in the Revelstoke TSA as soon as possible;

- *Caribou habitat* – that district, region and branch staff work together with licensee staff to determine how the work around spatial delineation of habitat could be applied to assist future timber supply analyses;

- *Stand level biodiversity* – that district staff work with licensee staff, and the staff of other ministries as appropriate, to refine estimates of the area retained in WTPs prior to the next determination, and give guidance on whether retention would be best reflected as an area or volume reduction for this particular TSA.

Jim Snetsinger
Chief Forester

August 4, 2005

Appendix 1: Section 8 of the *Forest Act*

Section 8 of the Forest Act, Revised Statutes of British Columbia 1996, reads as follows:

8. Allowable annual cut

8. (1) The chief forester must determine an allowable annual cut at least once every 5 years after the date of the last determination, for

(a) the Crown land in each timber supply area, excluding tree farm licence areas, community forest agreement areas and woodlot licence areas, and

(b) each tree farm licence area.

(2) If the minister

(a) makes an order under section 7 (b) respecting a timber supply area, or

(b) amends or enters into a tree farm licence to accomplish a result set out under section 39 (2) or (3),

the chief forester must make an allowable annual cut determination under subsection (1) for the timber supply area or tree farm licence area

(c) within 5 years after the order under paragraph (a) or the amendment or entering into under paragraph (b), and

(d) after the determination under paragraph (c), at least once every 5 years after the date of the last determination.

(3) If

(a) the allowable annual cut for the tree farm licence area is reduced under section 9 (3), and

(b) the chief forester subsequently determines, under subsection (1) of this section, the allowable annual cut for the tree farm licence area,

the chief forester must determine an allowable annual cut at least once every 5 years from the date the allowable annual cut under subsection (1) of this section is effective under section 9 (6).

(3.1) If, in respect of the allowable annual cut for a timber supply area or tree farm licence area, the chief forester considers that the allowable annual cut that was determined under subsection (1) is not likely to be changed significantly with a new determination, then, despite subsections (1) to (3), the chief forester

(a) by written order may postpone the next determination under subsection (1) to a date that is up to 10 years after the date of the relevant last determination, and

(b) must give written reasons for the postponement.

(3.2) If the chief forester, having made an order under subsection (3.1), considers that because of changed circumstances the allowable annual cut that was determined under subsection (1) for a timber supply area or tree farm licence area is likely to be changed significantly with a new determination, he or she

(a) by written order may rescind the order made under subsection (3.1) and set an earlier date for the next determination under subsection (1), and

(b) must give written reasons for setting the earlier date.

(4) If the allowable annual cut for the tree farm licence area is reduced under section 9 (3), the chief forester is not required to make the determination under subsection (1) of this section at the times set out in subsection (1) or (2) (c) or (d), but must make that determination within one year after the chief forester determines that the holder is in compliance with section 9 (2).

(5) In determining an allowable annual cut under subsection (1) the chief forester may specify portions of the allowable annual cut attributable to

(a) different types of timber and terrain in different parts of Crown land within a timber supply area or tree farm licence area,

(b) different types of timber and terrain in different parts of private land within a tree farm licence area, and

(c) repealed [1999-10-1].

(6) The regional manager or district manager must determine an allowable annual cut for each woodlot licence area, according to the licence.

(7) The regional manager or the regional manager's designate must determine an allowable annual cut for each community forest agreement area, in accordance with

(a) the community forest agreement, and

(b) any directions of the chief forester.

(8) In determining an allowable annual cut under subsection (1) the chief forester, despite anything to the contrary in an agreement listed in section 12, must consider

(a) the rate of timber production that may be sustained on the area, taking into account

(i) the composition of the forest and its expected rate of growth on the area,

(ii) the expected time that it will take the forest to become re-established on the area following denudation,

(iii) silviculture treatments to be applied to the area,

(iv) the stand of timber utilization and the allowance for decay, waste and breakage expected to be applied with respect to timber harvesting on the area,

(v) the constraints on the amount of timber produced from the area that reasonably can be expected by use of the area for purposes other than timber production, and

(vi) any other information that, in the chief forester's opinion, relates to the capability of the area to produce timber,

(b) the short and long term implications to British Columbia of alternative rates of timber harvesting from the area,

(c) Repealed. [2003-31-2 (B.C.Reg 401/2003)]

(d) the economic and social objectives of the government, as expressed by the minister, for the area, for the general region and for British Columbia, and

(e) abnormal infestations in and devastations of, and major salvage programs planned for, timber on the area.

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Appendix 2: Section 4 of the *Ministry of Forests Act*

Section 4 of the *Ministry of Forests Act* (consolidated 1988) reads as follows:

Purposes and functions of ministry

4. The purposes and functions of the ministry are, under the direction of the minister, to

   (a) encourage maximum productivity of the forest and range resources in British Columbia;

   (b) manage, protect and conserve the forest and range resources of the government, having regard to the immediate and long term economic and social benefits they may confer on British Columbia;

   (c) plan the use of the forest and range resources of the government, so that the production of timber and forage, the harvesting of timber, the grazing of livestock and the realization of fisheries, wildlife, water, outdoor recreation and other natural resource values are coordinated and integrated, in consultation and cooperation with other ministries and agencies of the government and with the private sector;

   (d) encourage a vigorous, efficient and world competitive timber processing industry in British Columbia; and

   (e) assert the financial interest of the government in its forest and range resources in a systematic and equitable manner.

Documents attached:

Appendix 3: Minister of Forests' letter of July 28, 1994

Appendix 4: Minister of Forests' memo of February 26, 1996

Appendix 5: Summary of Public Input

File: 10100-01

JUL 28 1994

John Cuthbert
Chief Forester
Ministry of Forests
595 Pandora Avenue
Victoria, British Columbia
V8W 3E7

Dear John Cuthbert:

Re: Economic and Social Objectives of the Crown

The *Forest Act* gives you the clear responsibility for determining Allowable Annual Cuts, decisions with far-reaching implications for the province's economy. The *Forest Act* provides that you consider the social and economic objectives of the Crown, as expressed by me, in making these determinations. The purpose of this letter is to provide this information to you.

The social and economic objectives expressed below should be considered in conjunction with environmental considerations as reflected in the Forest Practices Code, which requires recognition and better protection of non-timber values such as biodiversity, wildlife and water quality.

The government's general social and economic objectives for the forest sector are made clear in the goals of the Forest Renewal Program. In relation to the Allowable Annual Cut determinations you must make, I would emphasize the particular importance the government attaches to the continued availability of good forest jobs and to the long-term stability of communities that rely on forests.

Through the Forest Renewal Plan, the government is taking the steps necessary to facilitate the transition to more value-based management in the forest and the forest sector. We feel that adjustment costs should be minimized wherever possible, and to this end, any decreases in allowable cut at this time should be no larger than are necessary to avoid compromising long-run sustainability.

.../2

Province of
British Columbia

Minister of
Forests

Parliament Buildings
Victoria, British Columbia
V8V 1X4

In addition to the provincial perspective, you should also consider important local social and economic objectives that may be derived from the public input on the Timber Supply Review discussion papers where these are consistent with the government's broader objectives.

Finally, I would note that improving economic conditions may make it possible to harvest timber which has typically not been used in the past. For example, use of wood from commercial thinnings and previously uneconomic areas may assist in maintaining harvests without violating forest practices constraints. I urge you to consider all available vehicles, such as partitioned cuts, which could provide the forest industry with the opportunity and incentive to demonstrate their ability to utilize such timber resources.

Yours truly,

Andrew Petter
Minister

Province of British Columbia
OFFICE OF THE MINISTER

Ministry of Forests

MEMORANDUM

File: 16290-01

February 26, 1996

To: Larry Pedersen
Chief Forester

From: The Honourable Andrew Petter
Minister of Forests

Re: **The Crown's Economic And Social Objectives Regarding Visual Resources**

Further to my letter of July 29, 1994, to your predecessor, wherein I expressed the economic and social objectives of the Crown in accordance with Section 7 of the *Forest Act*, I would like to elaborate upon these objectives as they relate to visual resources.

British Columbia's scenic landscapes are a part of its heritage and a resource base underlying much of its tourism industry. They also provide timber supplies that are of significant economic and social importance to forest industry dependent communities.

Accordingly, one of the Crown's objectives is to ensure an appropriate balance within timber supply areas and tree farm licence areas between protecting visual resources and minimizing the impact of such protection measures on timber supplies.

As you know, I have directed that the policy on management of scenic landscapes should be modified in light of the beneficial effects of the Forest Practices Code. In general, the new policy should ensure that establishment and administration of visual quality objectives is less restrictive on timber harvesting. This change is possible because alternative harvesting approaches as well as overall improvement in forest practices will result in reduced detrimental impacts on visually sensitive areas. Also, I anticipate that the Forest Practices Code will lead to a greater public awareness that forest harvesting is being conducted in a responsible, environmentally sound manner, and therefore to a decreased public reaction to its visible effects on the landscape. In relation to the Allowable Annual Cuts determinations that you make, please consider the effects that the new policy will have in each Timber Supply Area and Tree Farm Licence.

.../2

In keeping with my earlier letter, I would re-emphasize the Crown's objectives to ensure community stability and minimize adjustment costs as the forest sector moves to more value-based management. I believe that the appropriate balance between timber and visual resources will be achieved if decisions are made consistent with the ministry's February 1996 report *The Forest Practices Code: Timber Supply Analysis.*

Finally, in my previous letter I had asked that local economic and social objectives be considered. Please ensure that local views on the balance between timber and visual resources are taken into account within the context of government's broader objectives.

Andrew Petter
Minister of Forests

Appendix 5: Summary of Public Input

The following submissions were received to the Information Report:

Shuswap Nation Tribal Council

The following submissions were received to the Analysis Report:

Downie Street Sawmills

Bell Pole Company

Parks Canada